MICHIGAN
OCZM GRANT #NA-80-AA-H-CZ157
SUBTASK 3D - 4.1

HAGAR TOWNSHIP

Park Development Plan and Recommendations for Beach & Bluff Stabilization

PREPARED BY:

ABONMARCHE CONSULTANTS, INC.
95 W. MAIN
BENTON HARBOR, MICHIGAN

This document was prepared in part
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National Oceanic and Atmospheric Administration

18263

ABONMARCHE CONSULTANTS, INC.

95 W. MAIN STREET BENTON HARBOR, MICH. 49022 PHONE: 927-2295

September 14, 1981

Hagar Township Board of Trustees
P.O. Box 135
Riverside, Michigan 49084

Ladies and Gentlemen:

It is with great pleasure that we herewith transmit the "Hagar Township Park Development Plan and Recommendations for Beach and Bluff Stabilization". We appreciate your participation and co-operation in the preparation of this Plan. Your input has ensured that the proposed project meets the communities needs in a realistic manner.

Abonmarche Consultants, Inc. looks forward to working with you in implementing the proposed park improvements.

Again, thank you for the opportunity to work with you.

Very truly yours,

ABONMARCHE CONSULTANTS, INC.

Ronald E. Schults, Manager

Brian W. Sodt, AICP

/f

EDWARD BRODERICK, Supervisor HOWARD BISHOP, Clerk FRANCES MARSALA, Treasurer

HAGAR TOWNSHIP

BERRIEN COUNTY

P.O. Box 135 Riverside, Michigan 49084

September 15, 1981

Mr. Chris A. Shafer, Chief
Great Lakes Shorelands Section
Department of Natural Resources
Box 30028
Lansing, MI 48909

Dear Mr. Shafer;

Please be advised that the Hagar Township Board of Trustees, at a regular meeting on September 14, 1981, accepted and approved the Hagar Township Park Development Plan and Recommendations for Bluff Stabilization as prepared by Abonmarche Consultants, Inc. Previously at a September 1, special meeting, the Township Board passed a resolution selecting Alternate III as proposed in the study for implementation in fiscal year 1981-82.

The Hagar Township Board wishes to express its gratitude to you and your staff for your cooperation and assistance in making this project possible. We look forward to working with you and our consultant in taking this project from a plan to creating a fine shoreland recreational facility.

Thank you for your assistance.

Sincerely,

Edward Broderick

EDWARD BRODERICK
Township Supervisor

/f

THIS PROJECT WAS FUNDED THROUGH

THE FEDERAL COASTAL ZONE MANAGEMENT PROGRAM

BY

THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES,

GREAT LAKES SHORELANDS SECTION

WE WISH TO THANK

MR. CHRIS A. SHAFER,

AND

MS. MINDY KOCH

FOR THEIR ASSISTANCE

IN MAKING THIS PROJECT POSSIBLE.

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SECTION I

HAGAR TOWNSHIP PARK

SITE ANALYSIS

ABONMARCHE CONSULTANTS, INC.
Benton Harbor, Michigan

August, 1981

1. INVENTORY AND ANALYSIS OF EXISTING SITE CHARACTERISTICS

1.1 Location:

Hagar Township Park is an approximately six acre park on Lake Michigan in Section 15 of Hagar Township, off US 33 at the intersection of Bundy Road.

The park property includes roughly 450' of Lake Michigan beach frontage backed by a 45' bluff. Historically the beach and bluff area have been highly erodible during periods of high water and storms.

1.2 Soils:

The majority of the park area, between the bluff and a creek ravine along US 33, is composed of Oakville Fine Sand soils. These soils are characterized as a nearly level to gently sloping well drained soil. This soil has fair potential for recreational uses and woodland uses as is demonstrated by the wooded nature of the property.

Septic tank absorption fields drain too well and filtering is poor. Seepage is common and may be evident along the bluff face.

For landscaping purposes, tree plantings suited to this soil include: Red Pine, Eastren White Pine, Jack Pine, Norway Spruce, Black Spruce, and Black Cherry. Excellent windbreak shrubs include: Vanhoutte Spirea, Autumn Olive and Tatarian Honeysuckle. Autumn Olive is an especially suitable hedge or buffer which

also provides song bird food and cover.

The sandy nature of the soil provides difficulties in developing picnic areas and playgrounds. There are also moderate constraints for lawns and landscaping due to the droughty nature of the soil.

1.3 Hydrology:

A natural watercourse parallels US 33, just inside the park property. This creek has created a shallow ravine. The ravine is well wooded and is remarkably undisturbed for an active public park. A County drain flows into the creek just north of the park property. However, the creek is not a County drain and flows across US 33 twice more before flowing into Lake Michigan about a half mile north of the park.

The bluff face and pedestrian walkway show some water seepage, either from the creek, a drain field, or a perched water table. The park property drains both to the creek and to Lake Michigan. Storm water runoff doesn't seem to be a major erosion problem except along the pedestrian walkway.

1.4 Vegetation and Wildlife:

Hagar Township Park is predominantly a disturbed Climax Forest community. Oak, Maple, and Beech mature trees dominate the overstory. Various shrubs including Sasafrass are characteristic of what little understory is present. Some wildflowers including Trillium are present in the creek ravine.

Due to unrestrained automobile access to the majority of

the park, little plant growth other than mature trees is evident in the central portion of the park. Pedestrian traffic along the bluff face has largely eliminated most of the vegetation which could stabilize the bluff face.

Numerous small mammals are evident in the ravine area. Due to the parks location on the Lake Michigan Flyway for migratory birds, it is a popular birding spot for local ornithologists during fall and spring migrations. Many varietys of birds are evident seasonally. Warblers, and shorebirds are quite common. Bald and Golden Eagles have occasionally been spotted in the park area as well as various hawks.

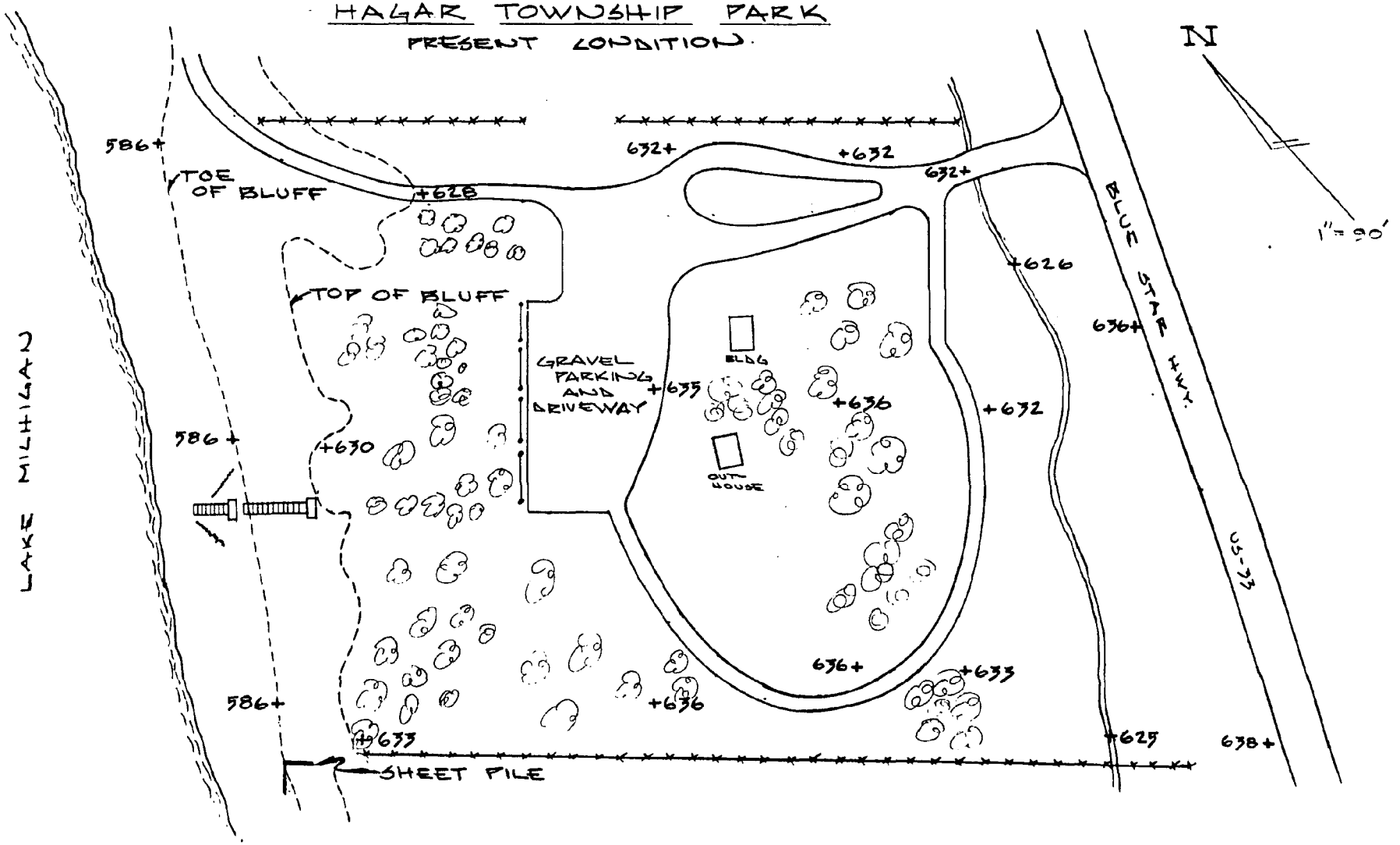
Future planting selections for boundary buffers can also serve as a wildlife management tool, increasing shelter and food supply for migratory birds while contributing to the recreational potential of the park site.

1.5 Topography:

With the exception of the lake bluff, creek ravine, and pedestrian walkway, the park site is comparatively level. The south central area of the park forms a slight rise of about 3' over the surrounding area. The northern boundary is about 4' lower than the access road. The lake bluff is about 45' above the beach and presents a fairly precipitous face. The bluff is the dominant topographic feature of the site, providing an excellent view while also posing serious erosion and safety problems. The bluff will be dealt with in considerable detail in the section "Recommendations For Beach And Bluff Stabilization Of Hagar Township Park".

HAGAR TOWNSHIP PARK

PRESENT CONDITION.



WATER ELEV. @ TIME OF SURVEY
579.1 (7/1/81)

ABONMARCHE CONSULTANTS, INC.
ENGINEERS-PLANNERS-SURVEYORS

1.6 Existing Park Development:

Two buildings are located on the property, a storage building and a toilet. Both structures are functional, but are in need of modernization and maintenance.

The entrance drive crosses the creek with a culvert. The sides of the drive are eroded and should be stabilized. The drive should be widened as park use increases. The park entrance is not properly marked and has a poor sight line to approaching traffic.

A derelict steel and concrete stairway to the beach presents a safety hazard and is an eyesore. It should be removed.

Several vehicular guardrails are located in the park. In practice,they do not control vehicle access and should be removed. More effective measures should be installed to control vehicle access.

The existing graded walkway to the beach is in poor condition. It is eroded and provides poor footing. The sides must be stabilized and the lower steep incline to the beach should be leveled off. A surfaced pedestrian walkway to channel foot traffic to the beach and away from the Bluff would be desirable.

A public right of way is indicated on the plat of Beachwood on Lake Michigan, along the north edge of the park site. This right of way is the property of the Township and can be vacated as long as the property is used as a public park. The right of way is not part of the subdivision plat and has never been dedicated as a County road.

Several cottages use this right of way for access, making it difficult to control access to the park property.

The north and south boundaries of the park are fenced. The fences are in poor condition and in need of replacement. There are no natural buffers along the north or south property lines. The creek ravine and foliage provide an excellent natural buffer to US 33.

Electricity and water are available on site. A new 2" well has recently been provided. The toilets have been provided with an adjacent dry well. Although the toilets could be improved, utilities appear adequate for future development.

2. DEVELOPMENT CONSTRAINTS

2.1 Bluff Face:

The erosion potential to the lake bluff is well documented in the engineering analysis. Any potential solution or mitigation measure will key upon eliminating pedestrian access to the bluff face. The bluff and/or appropriate setback must be fenced and be considered to have no use potential.

2.2 Creek Ravine:

In its present form the creek ravine serves as an excellent buffer to US 33 and as a small natural area. Excessive foot traffic should be discouraged. This area should be managed as a passive use area with limited intrusion.

2.3 Public Highway:

The mapped right of way on the north edge of the site should be vacated. Access to the adjacent cottages should be maintained. Parking should be consolidated in the right of way area to isolate auto traffic from the recreational potential of the site.

2.4 Residential Development:

The adjacent residences to the south of the park property should be buffered.

3. DEVELOPMENT ASSETS

3.1 Beach:

During periods of normal water levels the park possesses an excellent beach. With improvements, the walkway to the beach is well located in respect to a potential parking area. The existing stairway should be removed.

3.2 Forestation:

The numerous mature hardwoods throughout the park provide a strong aesthetic impact. The combination of shade and a lake breeze provide a delightful environment on summer days.

A 200' wide zone along the bluff is more heavily wooded. The root systems of the trees help stabilize the bluff top. This area is an ideal picnic area.

3.3 Activity Area:

The south central portion of the park will lend itself well to a more active recreation area as it is more open. Some carefully selected trees could be removed, more mature healthy trees should be retained where possible.

Tree removal and landscaping will depend on activities

selected for development. About two (2) acres are available for the activity area. Soil constraints largely eliminate turf based activities. The limited area eliminates ball diamonds.

Some suitable activities include:

1. Childrens playground with equipment
2. Basketball or volleyball
3. Tennis
4. Platform tennis or paddle tennis
5. Shuffleboard
6. Badminton
7. Handball (single wall)

With the exception of the playground, all of these activities require a hard surface.

4. SITE ANALYSIS CONCLUSION

Hagar Township Park is well located, and has numerous attributes for a family oriented community recreational facility. Beach activities, picnicking, and small scale active, recreational games can be provided in a natural manner compatible with surrounding development.

The site is not suited to intensive large scale spectator sports.

If available parking is restricted to the northern portion of the site, the facility will accommodate over one hundred (100) vehicles, a suitable amount for the size and activity potential of the site.

Fencing off the bluff face and the parking area will control access and minimize vandalism while still providing access to the adjacent cottages.

5. RECOMMENDED SITE DEVELOPMENT

5.1 Public Right-Of-Way

Research and discussions with the township attorney indicate that the 66' public right-of-way can be closed by township board action with the entire right-of-way remaining property of the township provided access to the cottages utilizing a portion of the right-of-way is maintained. Status of this right-of-way is of great concern since improvements to the park must be protected from vandalism by controlling public access and restricting access when the park is closed and unsupervised.

Access to the adjacent cottages should be maintained through development of the adjacent parking lot. That remaining portion of the right of way should then be vacated and subsequently utilized as a pedestrian walkway to the beach area.

5.2 Parking Lot

A parking lot with a capacity of 110 cars should be developed on the northeast corner of the site. Occupying over 29,000 sq. ft., this lot should be fenced from the remainder of the park and from adjoining development to the north. All pedestrian traffic would be channeled through a 12' gate at the head of the existing pathway down to the beach. All vehicular traffic would be restricted to an area adjacent to the park entrance, separating the pedestrian from the vehicle as soon as possible and maximizing the recreational potential of the remainder of the site.

Complete fencing of the lot from the remainder of the park will allow continued access to the adjacent cottages after the

park is closed. As the lot will remain accessible after hours, it should be well lit.

Construction of the parking lot may require eventual removal of up to eight trees to allow maximum utilization of the lot. However, where the trees do not interfere with necessary grading or drives, they should be retained if not diseased or otherwise damaged.

The lot will need to be graded and graveled. Concrete car stops or guard rails should be utilized to indicate the layout of parking spaces.

The entrance drive to US 33 will need eventual improvement. Brush and trees should be removed to improve sight line to oncoming traffic. US 33 should be properly posted with park entrance signs. The drive should be widened to two lanes and guard rails installed.

5.3 Activity Center

The central 1.8 acres of the park are well suited to more active recreational uses. Due to the complete lack of recreational facilities in the township, future development of the activity center takes on special importance. Potential improvements include, playground equipment and two tennis courts. There is sufficient area for additional court-type activities or simply grading a cleared open area for equipment which could be brought by the public,such as, badminton or volleyball. Playground equipment should be installed close enough to the picnic area to allow suitable parental supervision.

5.4 Picnic Area

The wooded portion of the site overlooking Lake Michigan is well suited for development as a picnic area. The large mature trees and comparative lack of underbrush minimize site preparation. Essentially, all that is needed is to remove guard rails from the existing gravel parking area and install tables, grills and trash barrels. A water line could be extended from the well house to the picnic area. The guard rails could be reused along the entrance drive over the creek culvert.

A pavilion is often a popular improvement to picnic areas, providing shade and shelter. Due to the heavily wooded nature of this site, it is questionable whether it would justify the expense.

5.5 Creek Ravine

It is recommended that the wooded creek ravine be maintained in its natural state. Excessive pedestrian traffic should be discouraged. Although limited in size the creek ravine is a quality natural area and serves as an excellent noise and sight buffer to U.S. 33.

5.6 Bluff Face Landscape Improvements

To minimize further erosion to the bluff face from human activity, pedestrian access must be eliminated. This may be accomplished in two ways. A chain link fence and appropriate vegetation will discourage foot traffic.

A 4' chain link fence should be installed parallel to the

bluff roughly 20' back from the edge. The fence should extend from the south property line to the pedestrian walkway. A 4' fence will not obscure the view to the lake but will encourage use of the walkway. The area between the fence and the bluff edge should be planted to robinhood rose hedge, buffalo berry, or red, green or winter barberry. Hedging grade stock should be installed 2 to 3' apart and will require little maintenance other than occasional pruning where appropriate.

The bluff face itself provides additional problems. The bluff is predominately clay along the base extending in some areas up over 20'. The upper portion of the bluff is predominately sand. The majority of the existing ground cover is a variety of spurge. This plant is of little value except in minimizing wind erosion to some degree.

American beach grass should be planted in the upper sand portions of the bluff. With foot traffic eliminated, the beach grass should establish well and gradually push out less desirable species such as the spurge.

The lower lying heavy clay strata is often accompanied by springs or wheeping from the bluff face. Discussions with area nurserymen suggest a different type planting. Black locust is recommended. This is a 20-30' tree with thorns and an extremely heavy root development. This should be planted 3' apart in alternate rows over the lower half of the bluff, above the rip rap at the bluff toe. Even as a young plant, the black locust will serve as a thorny hedge discouraging pedestrian access from the beach. The black locust will do very

well in the heavy clay and root development will tend to eliminate the springs and wheeping with the trees using much of the available water. Heavy root growth will compliment other measures in tying down the toe of the bluff. Local experience indicates areas planted to black locust are among the last to be eroded by lake action. It is a fairly clean tree with little leaf debris.

An appropriate mixture of fencing and landscaping will largely eliminate foot traffic, thereby allowing the bluff face to stabilize. Channeling beach users from the parking lot directly to the pedestrian walkway will further minimize the tendency to use the bluff face as a "short cut".

5.7 Additional Landscaping

The only additionally recommended landscaping is a hedge along the south property line to serve as a buffer. Hedge quality autumn olive is recommended. It will do well on this soil, will form a dense buffer from 8 to 10' high, and, in addition, autumn olive will provide song bird food further enhancing the natural attributes of this site.

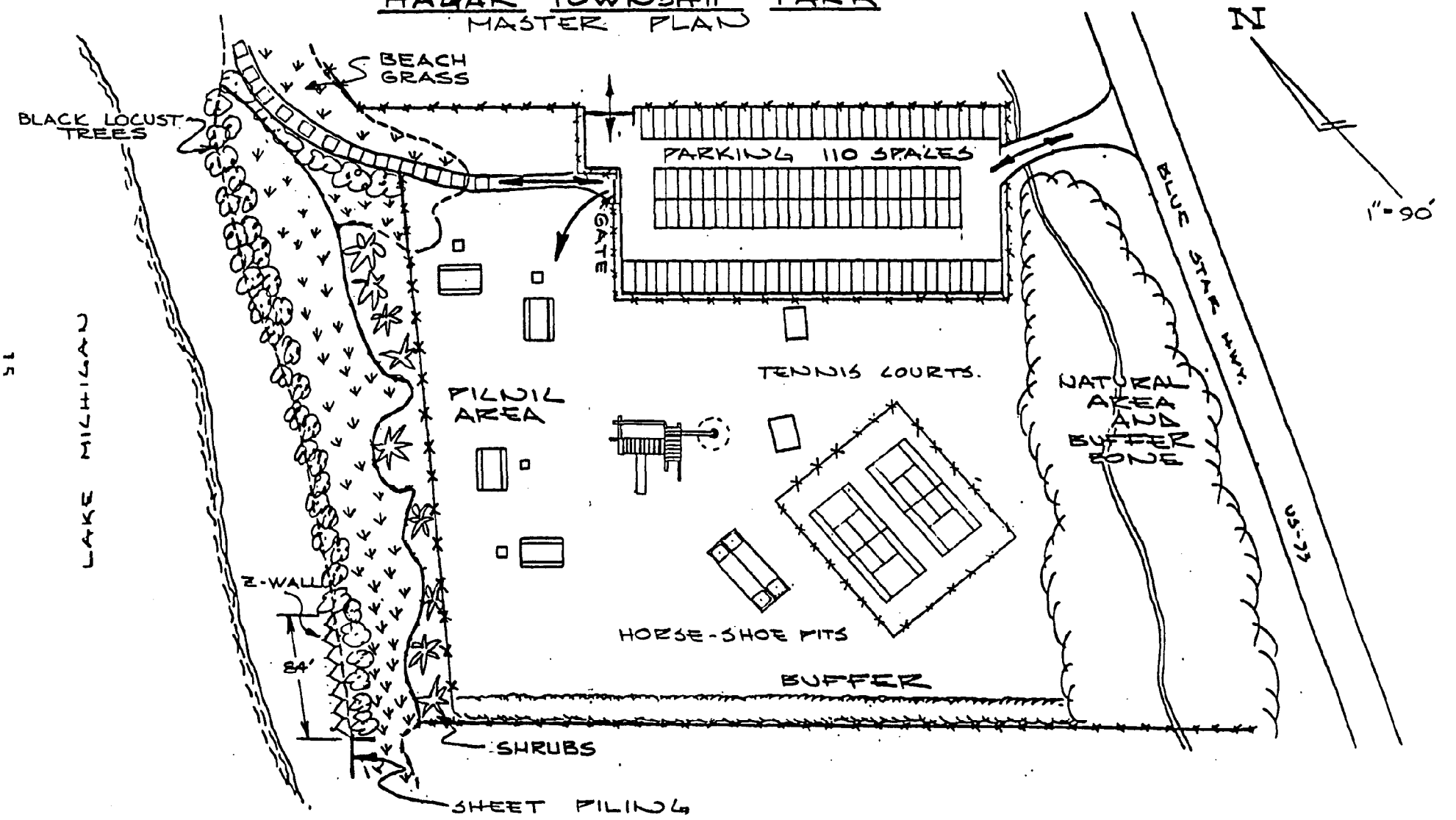
5.8 Perimeter Fencing

As site improvements are installed, the township may wish to complete fencing the perimeter of the park. Fencing the parking lot will be sufficient initially.

Six foot chain link should then be installed along the north and south property lines and possibly along US 33 behind the existing guard rail. The Berrien County Road Commission should

be contacted to determine fence location, preferably behind the guard rail but out of the ravine itself.

HAGAR TOWNSHIP PARK
MASTER PLAN



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SECTION II

HAGAR TOWNSHIP PARK

RECOMMENDATIONS

FOR BEACH AND BLUFF STABILIZATION

D. C. Wiggert, P.E., Phd.

R. J. B. Bouwmeester, Phd.

and

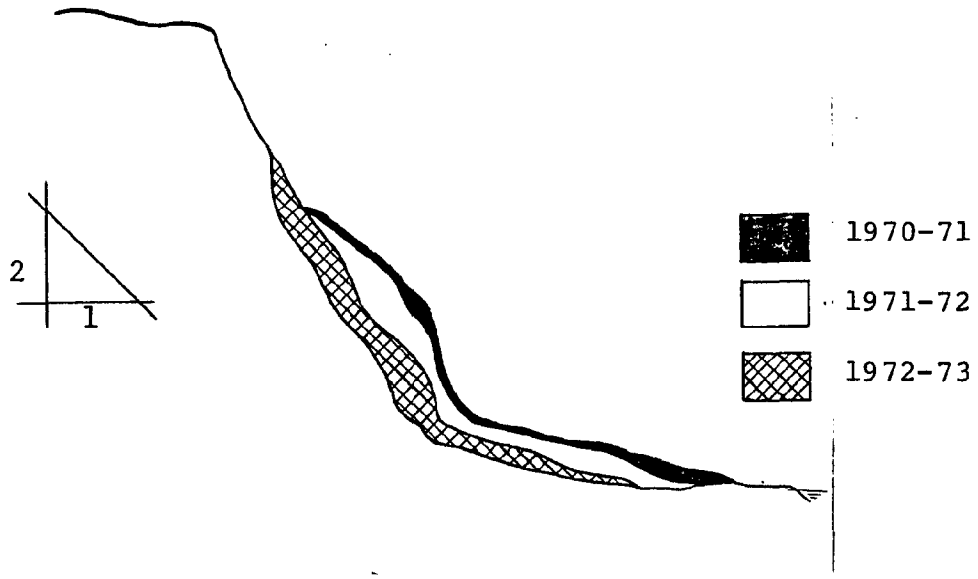
ABONMARCHE CONSULTANTS, INC.
Benton Harbor, Michigan

August, 1981

6. BEACH AND BLUFF-TOE STABILIZATION

6.1 Introduction

The Hagar Township Park is located in an area of fairly high bluffs of glacial drift. The bluffs rise about 40 feet above lake level and have in the past decade receded as a result of periods of high lake levels and storms. During a three-year period (1970-1973) net annual changes in beach and bluff profiles were recorded by Davis (Reference 1). These profiles are reproduced below to demonstrate the erosion problems at this site.



The beach width of Hagar Township Park has fluctuated considerably. This is in part a result of water level fluctuations of the lake, and in part due to erosion and accretion of the beach itself.

In order to illustrate in more detail the nature of the erosion problems, some observations made by Davis (Reference 1)

are quoted:

> A modest beach was present at the beginning of the study. After an initial period of beach erosion, some accretion occurred in October 1970, followed by more erosion up until shore-ice formation. After the shore-ice breakup, the beach was similar to that at the start of the study, and a swash bar was present. Growth of the beach continued although there was some erosion in May and July of the first year.
>
> Late summer of 1971 was characterized by modest erosion followed by accretion. Erosion was dominant during the late fall high-energy period, and minor beach erosion and bluff recession followed the melting of shore ice. This continued through the remainder of the second year.
>
> Early fall was a period of much beach erosion although there was accretion in the usually high-energy month of November 1972. The spring of 1973 was marked by erosion to the extent that by June there was no beach and about 1 foot of water at the base of the bluff. Slumping and some recession of the bluff also occurred in this period.

Based on observations made at Hagar Township Park during the final year, Davis Concludes:

> The beach at this site is narrow, and even during minor storms waves attack the base of the clayey bluff. The clay till is soft and almost quick due to a very high moisture content. Erosion to the toe of the bluff results in mass wasting and much loss of material from the profile.

6.2 Beach Stabilization

The large fluctuations in beach width are associated with the occurrence of the relatively large variations in lake level and with the occurrence of storms. Major beach erosion occurs particularly during storms approaching from the north and northwest when the lake water levels are high. Under these conditions, the wave energy approaching the shore is maximum as a result of

the long fetch and the high water levels, while the angle of wave attack is such that strong longshore currents are generated yielding much potential for a quick transport of eroded sand.

Devices to retard or reduce erosion of an existing or restored beach include groins, Z-walls* (Reference 8), shore-connected breakwaters, offshore breakwaters, and others. Because Hagar Township Park beach is not intended to become a highly developed recreational facility, it seems that any type of breakwater is cost excessive. Further, such structures may leave neighboring beaches more vulnerable to erosion. The desired stabilization of the beach may be achieved by a properly designed and constructed groin system. The periods of rapid accretion of beaches in this area are an indication that long-shore sediment transport is sufficient to prevent significant downdrift beach erosion.

6.3 Recommended Groin System

A groin system is recommended that will trap enough sand to create a relatively stable beach or accretion of new beach areas. The height and length of the groins, however, will be sufficiently low and short to prevent erosion problems downdrift.

The selected number of groins and dimensions and spacing of the groins are based on design guidelines for the Great Lakes as established by the U.S. Army Corps of Engineers (Reference 2). The following groin system is proposed:

-- Three groins to be installed at 75, 200 and 325 feet south from the northern property line (see Exhibit 1);

-- The orientation of the groins is perpendicular to the shoreline;

*NOTE: When reference is made to Z-Wall's in this report, we do not necessarily refer to or endorse the manufacturer of the "Z-Wall", however, we are referring to a precast concrete "Z" or "W" shaped erosion control device. Presently, we are not aware of other equivalent or similar systems.

-- The groins are 50 feet long and are tied to the bluff;

-- The groin top level is at the "extraordinary" high water level which is 580.5 feet IGLD (International Great Lake Datum 1955);

-- The groin height is 15 feet;

-- The face of the groin is protected against scour by riprap stone;

-- Further construction details and dimensions of the groins are given in Exhibits 2 and 3.

6.4 Alternative Z-wall System

An alternative to wood groins to trap beach sand, maintain an existing beach and possibly create additional beach width is construction of a precast concrete Z-wall system. Although not considered as effective as wood groins in trapping littoral sand drift, Z-wall has been successful in reducing beach erosion and in some instances has maintained and created additional beach widths. The size and location of the Z-wall will be such that a minimum of beach erosion problems downdrift will be anticipated.

The following Z-wall system is proposed in two phases:

-- Phase I: Installation of 84 feet of Z-wall adjacent to and in line with the southerly neighboring property owners steel sheet pile retaining wall. The north end of the Z-wall would be tied back into the bluff with half Z-panels (see Exhibit 4);

-- Phase II: Installation of 98 feet of Z-wall from the northerly property line of Hagar Park south. This would protect the beach in front of the proposed access walkway (see Exhibit 4);

-- Phase I should be implemented immediately, and Phase II

should be implemented when continued serious beach erosion threatens the access walkway (presently, lake levels are such that adequate beach widths are found in this walkway area. Should future lake levels remain at existing elevations or drop, the Phase II Z-wall may not be required until such time when high lake levels are experienced);

-- The orientation of the Z-wall system is parallel to the shoreline;

-- The Z-wall panels would be placed directly on the existing beach near the existing shoreline. No dredging or fill would be required other than that necessary to place the panels in a level area;

-- The Z-wall height is six feet. Each panel is approximately 14 feet long. Two panels are required for each 14 lineal feet of shoreline protection;

-- The inside "vee" of the Z-wall is protected against scour by riprap stone;

-- Further construction details and dimensions of the groins are given in Exhibit 5.

6.5 Bluff-Toe Stabilization

The most critical aspect of the restoration of Hagar Township Park is the stabilization of the bluff-toe. Further erosion and recession of the bluff resulting from storms and high water levels can only be prevented by adequate toe protection. Although the proposed groin system has a stabilizing effect on the erosion process,

i.e., it retards and reduces the erosion, it is emphasized here that such a system does not provide adequate protection of the toe against major storms.

Devices to retard or reduce bluff erosion include, stone revetments, Z-walls , wood timber sheet piling, steel sheet piling and vertical concrete retaining walls.

6.6 Recommended Stone Revetment

A stone revetment placed at the toe of the bluff parallel to the shoreline is recommended to adequately protect the bluff against wave erosion and permit growth of a vegetative cover on the face after the slope is reduced by excavation (see Section 7.41). Such a structure is relatively economical (if stone material at the time of construction is sufficiently available) and is very effective in the dissipation of wave energy. Further, the recommended stone revetment will not cause unnecessary erosion of the beach when the bluff is attacked by waves, as would be the case, for example, with a vertical sea wall.

The design water level is based on a maximum hourly mean water level with an average return period of once in 20 years. This level is 581.9 feet IGLD and includes the effect of wind setup (Reference 5).

The design height of the stone revetment should be such that the design wave does not over-top the revetment; i.e. the height of the revetment should reach a level equal to design water level plus an estimated value for the wave runup. The wave runup is calculated using a formula given in Reference 6, namely,

$$R = H_{br} \frac{A}{B + \sqrt{H_{br}/L}\ \text{cotan}\ 0},$$

6.7 Alternative Z-wall System

An alternative to stabilize the toe is construction of a Z-wall across the entire length of the shoreline. The use of the Z-wall has shown to provide adequate toe protection for a majority of the wave attack to the bluff, however, due to the relative short height of the panels above the beach area, some over-topping due to extreme large wave actions may be anticipated. Additionally, the initial cost of the Z-wall is significantly lower than the stone revetment. The maintenance cost of the Z-wall are also anticipated to be significantly lower than those maintenance costs associated with the stone revetment.

6.8 Alternative Vertical Retaining Walls

A second alternative method to stabilize the toe is a vertical steel sheet pile, wood timber pile, or concrete sea wall. However, their destabilizing effects on the beach and relatively high costs make these methods less suitable for Hagar Township Park.

6.91 Effects on Neighboring Properties

The groins are designed sufficiently low and start back in the existing beach areas to prevent substantial erosion. With the net longshore transport from north to south (Reference 2), some minor erosion is possible south of the Park, However, if any erosion will occur, no damage to the southerly bluff will result because of the bluff protection by existing steel sheet piling.

The stone revetment will have no adverse effects on the properties on either side of Hagar Township Park. On the north side the stone revetment will effectively dissipate the wave energy so that no undesirable discontinuities in wave patterns result.

On the south side the stone revetment will stop the bluff erosion at the transition from the unprotected bluff of the Park to the steel piling of the neighboring property.

6.92 Comparison of Groin/Stone Revetment System to Z-wall System

A comparison of the overall impacts of the groin/stone revetment vs. Z-wall system follows:

-- Overall Beach Protection: Relative to the Z-wall system, and in areas of strong littoral currents, (such as Hagar Township Beach) groins appear to provide a larger increase in effectiveness for beach accretion.

-- Overall Bluff Toe Protection: Groins do not provide any direct substantial wave attack protection to the toe of the adjacent bluff. Z-wall systems have been found to provide a moderate level of bluff toe protection in conjunction with their ability for beach accretion. Properly designed stone revetments provide excellent bluff toe protection.

-- Effects on Neighboring Property Owners: Generally, groin systems have been found to result in some increases in erosion to neighboring property owners beach and bluff areas. Z-wall and stone revetment systems do not seem to cause significant increases in neighboring property erosion problems.

-- Objections to Construction Permit Application: Generally speaking, short groin systems (those less than 50' in length) and Z-walls proposed in the Southern Lake Michigan area have received few objections.

-- Initial and Maintenance Costs: The initial cost of the three groins and stone revetment is estimated at $188,750. The initial cost of the Z-wall systems are: Phase I - $16,200 and Phase II - $18,300; total both phases of $34,500. A Z-wall system across the entire length of beach area is estimated to cost $80,050.

Significant Maintenance costs to the groin/stone revetment system are expected to be incurred within 5-10 years after installation. The Maintenance cost of the Z-wall system is minimal throughout its useful life of 10-20 years.

-- Construction Effects: Both systems will be anticipated to be constructed using a crane/barge platform rig. Therefore, no significant differences in construction methods/effects are anticipated.

-- Aesthetic Appearance: Both the groin and Z-wall systems do not appear to have significant differences regarding objections to or other considerations due to appearance. The major differences on an overall basis of appearance that the groins are a wood timber material, and the Z-wall is a precast concrete material. The stone revetment, however, is often objected to in beach areas due to its appearance.

7. UPPER BLUFF STABILIZATION

7.1 Characteristics of Bluff

The bluff at the Hagar Township site consists predominantly of unconsolidated material with the presence of clay lenses exposed at the face. There is approximately a 44 feet drop to the beach, with a slope of 1.14 H : 1V. The face is highly erodable, both at the toe due to wave action, and at the upper regions due to causes mentioned below. This section will address the problem of upper bluff erosion and will suggest means to retard the bluff from rapid recession.

7.2 Causes of Erosion

There are three suspected sources of erosion on the upper bluff face. First, due to the presence of soil moisture, there was observed (on May 25, 1981) a substantial amount of groundwater seepage from the top sand layer and from the sand lenses interspersed in the lower lying clay material. This flow may be intermittent, occurring predominantly during the wet seasons. However, there may be more continuous sources of groundwater which would provide a continual seepage face to appear. Extensive seepage can lead to slumping of the bluff. In addition to natural groundwater movement, possible additional sources of seepage flow at the site are the drainage ditch located at the eastern extremity and a septic field (if one exists).

A second cause of erosion may be attributed to surface runoff from the upper ground level, and on the bluff face itself.

This overland flow process will create rill and gully erosion and ultimately seriously damage the bluff. Overland flow occurs due to precipitation excess, once the soil is incapable of absorbing moisture because of saturated conditions. An additional source of overland flow on the bluff face originates from the groundwater seepage faces. Overland flow is not considered to be a serious problem, except under extreme conditions of intense rainfall of sufficient duration or of intense snow melt. These events, combined with groundwater seepage on the face of the bluff, may contribute to surface erosion.

The third source of erosion stems from human activity, which at the Hagar Township site, takes place at a high level. The creation of footpaths on the bluff face leads to channelization of overland flow, and ultimately formation of gulleys. Vehicular activity close to the top of the bluff damages the vegetative cover there, which can lead to further surface erosion.

An additional source of bluff erosion is wind action. This is not considered to be a serious problem at the site except, perhaps, at the northern side where a sand bluff exists.

7.3 Recommended Remedies for Bluff Erosion

Due to the extreme erosion conditions in evidence at the site, an optimum recovery measure would be to utilize a combined management strategy of structural control at the toe of the bluff (see Section 1), drainage and vegetative controls on the face, and traffic control at the ground surface.

7.31 Control of Vehicular and Foot Traffic at Top of Bluff

Vehicles should be prevented from advancing beyond designated parking areas. Foot traffic is to be discouraged, if not prevented, from creating paths along the edge of the bluff and on the bluff face. A fence should be constructed, set back from the bluff edge, with a green belt provided in between. The foliage could consist of dense low growth, such as brambles to discourage pedestrian traffic. All access to the beach should be directed to the walkway on the north side of the site (see Section 3).

7.32 Drainage Controls at Ground Surface

An investigation could be conducted to see whether the highway drainage ditch and the septic field are causes of additional groundwater flow resulting in seepage faces occurring more continuously in the bluff face. If such is the case, the drainage ditch could be lined and the flow rechanneled to a drain pipe laid and buried in the north access site, and the tile field could be intercepted in a similar manner. We suspect that these flows either are intermittent or are insufficient to warrant detailed consideration. A more relevant problem is the presence of natural groundwater seepage on the face of the bluff. This is addressed in the following section.

7.4 Bluff Alteration

A major problem related to bluff stabilization at the site is the steepness of the bluff slope (1.14 H : 1V). This is

caused primarily by wave erosion at the toe and subsequent undermining of the clay wall. In addition, the gulley erosion taking place in the higher zones of the bluff tend to inhibit stabilization with appropriate vegetative cover. Any effective remedy to bluff erosion must consider major alterations to the bluff itself. Furthermore, it is necessary to account for the private property on either side of the site.

In order to stabilize the bluff, the primary task is to protect the toe from wave action. This is accomplished by construction of a revetment and enhancement of the beach (see Section 1). Two alternate bluff alterations are presented below, ranging from extreme modification (high cost) to minimal (low cost).

7.41 Alternate A (see Exhibit 8)

-- Excavate the bluff from a 1.14 H : 1 V slope to 1.5 H to 1 V slope. This would create an additional setback of 16 feet at ground level. Such an alteration would allow vegetative growth to become established on the face (Reference 3).
-- The south side of the site could receive the excess slope material to build up a terraced hillside to the adjacent private property.
-- Locate an interceptor file drain at the top of the bluff. Terrace the bluff face to create berms and drains midway and near the toe, to intercept runoff and seepage flows. The channels and tile drains are

to be routed to drain pipes down to the beach area.

-- Remove all fallen trees from the bluff area. Any trees removed at the top of the bluff should have their roots left intact to hold in the soil (Reference 3).

-- Establish vegetation on the face and top of the bluff. A dense cover should be selected (juniper, bramble, etc.) to discourage foot traffic. Use selective vegetation to provide an aesthetic view of the lake at the top of the bluff. Further down, it may be desirable to plant some trees -- willows are effective (Reference 3).

-- At the south side of the site the established hillside could be terraced with railroad ties (to be anchored into the bluff), and grasses and shrubs planted. This is an area which may require repeated maintenance.

-- At the north side of the site, the access walkway is to be developed (see Section 3). Plantings are to be provided to stabilize the bluff region: appropriate dense cover on the clay and beach grass on the sand (Reference 3).

7.42 Alternate B (see Exhibit 9)

-- Retain bluff with its present slope (1.14 H : 1 V). This will not halt the surface erosion process, since it is likely that vegetation will not grow effectively. However, toe erosion will be inhibited by construction of the revetment.

-- Attempt to intercept any significant groundwater seepage with lateral berms and surface drains channeled to the beach.

-- Remove fallen trees on bluff face. Trees removed at the top of the bluff should have their roots left intact to hold in the soil.

-- Prevent surface runoff at the top of the bluff by construction of a diversion berm.

-- If borrow material is available, terrace the south side of the site as in Alternate A, to protect the adjacent property from further erosion.

-- Alter the north side of the site as in Alternate A.

8. BEACH ACCESS

To prevent injury and enhance the visual aesthetics of the site, it is recommended that the unused stairway and foundation be removed. The north side access path must be developed to accommodate pedestrian traffic and minimize erosion damage. The natural slope of the access route is approximately 4 H : 1 V. This is to be maintained. The following alterations and additions are recommended (see Exhibit 10):

-- A sand bluff exists on the north side of the walkway, adjacent to private property. This bluff should be maintained by the planting of American beachgrass (Reference 4).

-- On the south side of the walkway, prepare a slope of 1.5 H : 1 V and plant appropriate vegetative cover

(beachgrass on sand and brambles and juniper plus trees on clay) to discourage foot traffic.

-- Walkway (Alternate A). Provide sectional platforms of treated wood placed with a 8 H : 1 V slope and fastened to railroad ties. The platforms are approximately 8 feet in length by 6 feet wide, and the ties are to be anchored into the bluff. (see Exhibit 11). With this design, a single step will be encountered every 8 feet.

-- Walkway (Alternate B). Lay the 8 feet by 6 feet platform directly on the natural 4 H : 1 V slope and anchor the upper end of each platform with 6 to 8 feet metal stakes (see Exhibit 12).

-- Handrails to be placed on both sides of walkway platform to assist pedestrians in ascent and descent, and to prevent traffic on adjacent bluff faces (see Exhibit 11).

Beach and Bluff Stabilization

of Hagar Township Park

Recommendation Summary

(listed in order of highest priority)

1. Placement of stone revetment and low-level groins at toe of bluff to inhibit wave erosion and stabilize beach.

   -- Alternative: Installation of Z-wall panels at toe of bluff to inhibit wave erosion and stabilize beach.

2. Development of beach access area:

   -- grade southern face to 1.5 H to 1 V to accommodate dense vegetation

   -- plant beach grass on northern face

   -- placement of walkway

3. Remove fallen trees on face of bluff and plant a green belt of dense vegetation at top of bluff. Construct fence to discourage foot traffic on bluff.

4. Remove stairway and foundation.

5. Stabilize bluff slope with terracing and drainage system.

References

1. "Coastal Changes, Eastern Lake Michigan, 1970-1973", Richard A. Davis, Jr., Technical Paper No. 76-16, U.S. Army Corps of Engineers, Coastal Engineering Research Center, October 1976.

2. "Help Yourself; A Discussion of Erosion Problems on the Great Lakes and Alternative Methods of Shore Protection:, U.S. Army Corps of Engineers, North Central Division, September 1978.

3. "The Role of Vegetation in Shoreline Management", prepared by the Great Lakes Basin Commission Staff, available from the Michigan Department of Natural Resources.

4. "Dune Building and Stabilization With Vegetation", Special Report No. 3, U.S. Army Corps of Engineers, Coastal Engineering Research Center, September 1978.

5. "Report on Great Lakes Open Coast Flood Levels," U.S. Army Corps of Engineers, February 1977.

6. "Two Dimensional Tests of Wave Transmission and Reflection Characteristics of Laboratory Breakwaters," William Feelig, Technical Report 80-1, U.S. Army, Coastal Engineering Research Center.

7. "Design Wave Information for the Great Lakes," Report No. 3, Lake Michigan. Hydraulics Laboratory, U.S. Army, Engineering Waterways Experiment Station, P.O. Box 631, Vicksburg, Mississippi, 39180, November 1976.

8. Z-walls, Speidel Foundation and Marine Inc., 220 North Wayne Street, St. Joseph, Michigan 49085, 1973.*NOTE: When reference is made to Z-wall's in this report, we do not necessarily refer to or endorse the manufacturer of the "Z-Wall", however, we are referring to a precast concrete "Z" or "W" shaped erosion control device. Presently, we are not aware of other equivalent or similar systems.

HAGAR TOWNSHIP PARK

ESTIMATED CONSTRUCTION COSTS

I. PARK DEVELOPMENT ITEMS

1.	Parking Lot Improvements		
	Grub and grade 30,000 sq. ft.		
	8" gravel compacted in place	= $11,100	
	85 parking stops @ $8.00 each*	= 680	
	2 floodlights @ $110.00 each	= 220	
	702 LF NBR chain link fence 6' high including one (1) 12' wide gate and 3" OD end, corner and gate posts	= 5,967	
		$17,967	$17,967
2.	Park Improvements		
	15 tables @ $165.00 each *	= $ 2,475	
	6 grills @ $80.00 each *	= 480	
	8 drum caps @ $35.00 each *	= 280	
	1 redwood playstructure 22' * X 27', capacity, 20 - 25 kids, includes: chain ladder, chinning bar slide, main structure, swing, and ring swing	= 3,000	
	2 tennis courts, including fencing	20,000	
	1440 LF of 6' high NBR chain link fencing @ 7.50 LF installed	= 10,800	
	95 hedge quality autumn olive *	= 100	
		$37,135	$37,135
3.	Park Entrance Drive Improvements		
	Remove miscellaneous shrubs etc.	= $ 1,000	
	Fill at entrance	= 1,200	
	Guard rail*	= 100	
	Relocate power pole	= 500	
	Gravel	= 600	
		$ 3,400	$ 3,400

* All items noted with asterisk do not include labor cost for installation. All others assume installed cost by outside contractors.

Note: Construction cost of horseshoe pits is assumed to be by Hagar Township personnel.

II. BEACH AND BLUFF EROSION CONTROL ITEMS

1. Remove existing stairway, foundations, trees and sheet piling		$ 6,000
2. Install Wood Groins		
150 LF Groin @ $195.00	= $29,250	
30 Ton Rip Rap @ $35.00	= 1,050	
Engineering, Administration & Contingency @ 15%	= 4,550	
	$34,850	$34,850
3. Install Z-wall Beach Protection		
Phase I		
84 LF Z-wall @ $170.00	= $14,280	
12 Ton Rip Rap @ $35.00	= 420	
Engineering, Administration & Contingency @ 15%	= 2,200	
	$16,900	$16,900
Phase II		
98 LF Z-wall @ $170.00	= $16,600	
15 Ton Rip Rap @ $35.00	= 525	
Engineering, Administration & Contingency @ 15%	= 2,515	
	$19,700	$19,700
4. Install Stone Revetment - Bluff Protection		
Excavation, filter cloth, small and large rip rap stone, 425 LF @ $315.00	= $133,875	
Engineering, Administration & Contingency @ 15%	= 20,025	
	$133,875	$153,900
5. Install Z-wall Revetment - Bluff Protection		
425 LF Z-wall @ $165.00	= $70,125	
60 Ton Rip Rap @ $35.00	= 2,100	
Engineering, Administration & Contingency @ 15%	= 10,825	
	$80,050	$80,050

NOTE: If the Z-wall systems in Item 3 of Phase I and Phase II beach protection are implemented in conjunction with this bluff protection system, the total lineal feet of Z-wall may be reduced by the length of the wall as described in Phase I and II. The total cost would also be reduced accordingly.

III. BLUFF STABILIZATION ITEMS

1. Bluff Set Back Alternate

Excavate bluff for 1.5 : 1.0 slope	$7,500	
Plant beach grass/black locust *	2,000	
Berm 1/3 slope and provide drainage tiles **	10,000	
Install fence across top of bluff 360 LF @ ¢6.00	2,160	
Engineering, Administration & Contingency @ 15%	3,240	
	$24,900	$24,900

2. Bluff Diversion Berm/Inter ceptor Drain Alternate

Soil Borings/Moniter Wells	$2,000	
Drainage tile along top of bluff 400 LF @ $13.00	5,200	
Drainage tile to toe of bluff 100 LF @ $30.00	3,000	
Leaching basin at toe of bluff 2 EA @ $1,500	3,000	
Lateral berms with drains 15 EA @ $600	9,000	
Plant Beach Grass/Black Locust*	2,000	
Install fence across top of bluff 360 LF @ $6.00	2,160	
Engineering, Administration & Contingency @ 15%	3,940	
	$30,300	$30,300

3. Wooden Beach Access Walkway

Alternative A - Railroad Tie Anchors

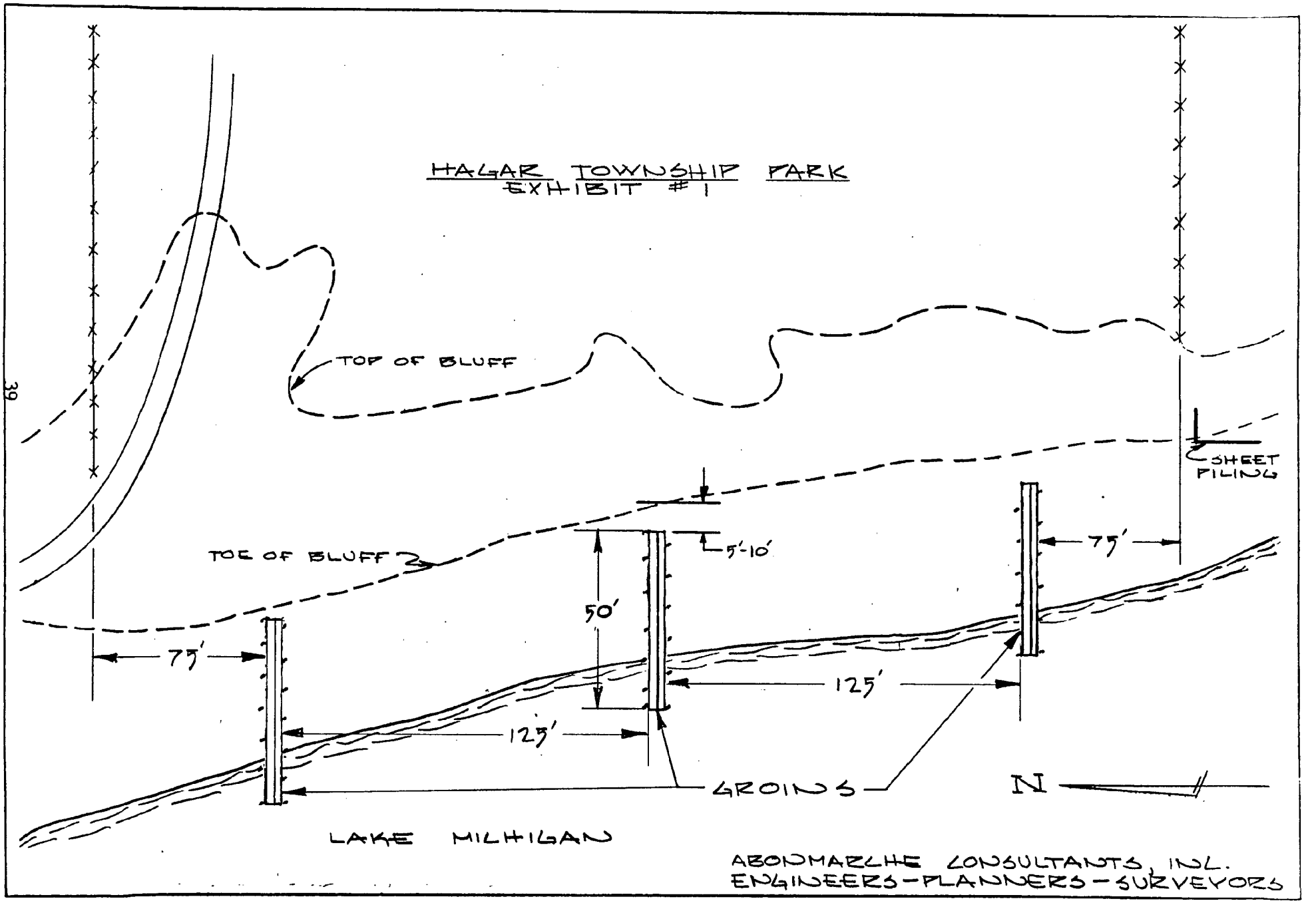
Treated wooden deck 1200 SF @ $5.00	$ 6,000	
Railroad tie anchors 50 each @ $56.00	2,800	
Hand rail (both sides walk-way) 200 LF @ $5.00	1,000	
Beach Grass/Black Locust along walkway*	500	
Engineering, Administration & Contingency @ 15%	1,500	
	$11,800	$11,800

Alternative B - Screw Type/Stake Anchors

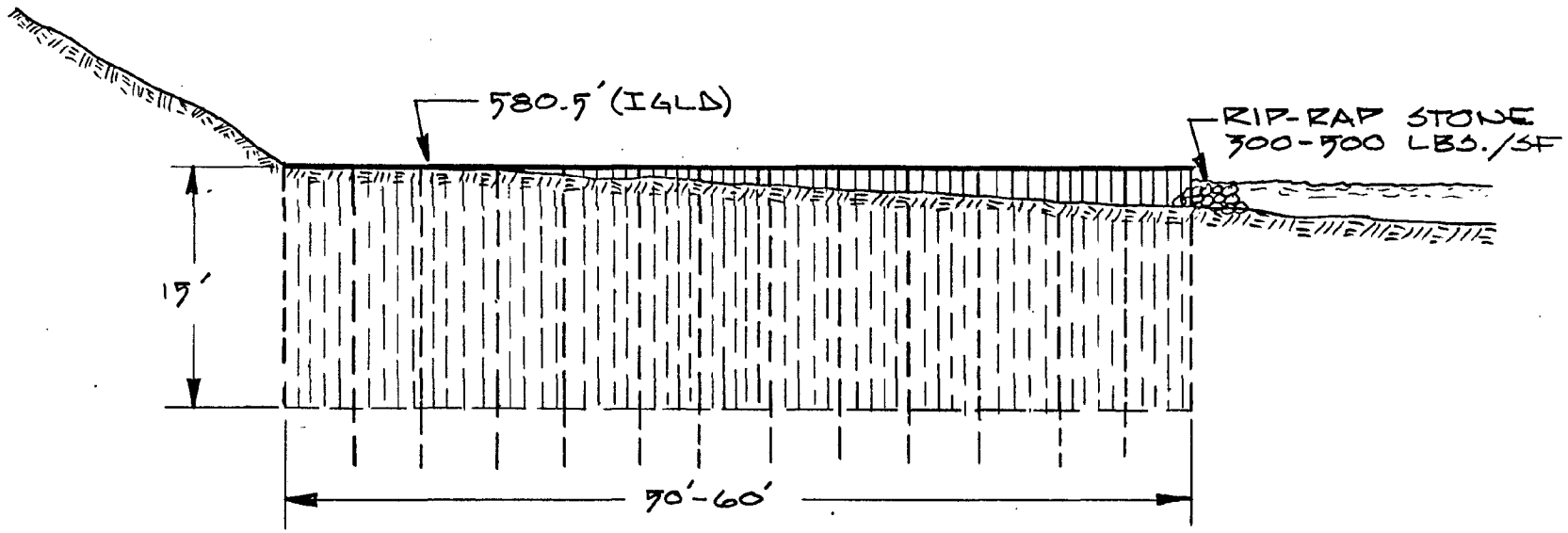
Treated wood deck 1200 SF @ $5.00	$ 6,000	
Screw type/stake anchors 50 each @ $35.00	1,750	
Hand rails (both sides of walkway) 200 LF @ $5.00	1,000	

Beach Grass/Black Locust along walkway*	500	
Engineering, Administration & Contingency @ 15%	1,350	
	$10,600	$10,600

* (See previous note)
**Water absorption by the Black Locust trees may be sufficient to mitigate seepage from watertable, thus not requiring this item.


HAGAR TOWNSHIP PARK
EXHIBIT #1
TOP OF BLUFF
SHEET PILING
TOE OF BLUFF
5'-10'
50'
75'
75'
125'
125'
GROINS
N
LAKE MILHIGAN
ABONMARCHE CONSULTANTS, INC.
ENGINEERS-PLANNERS-SURVEYORS

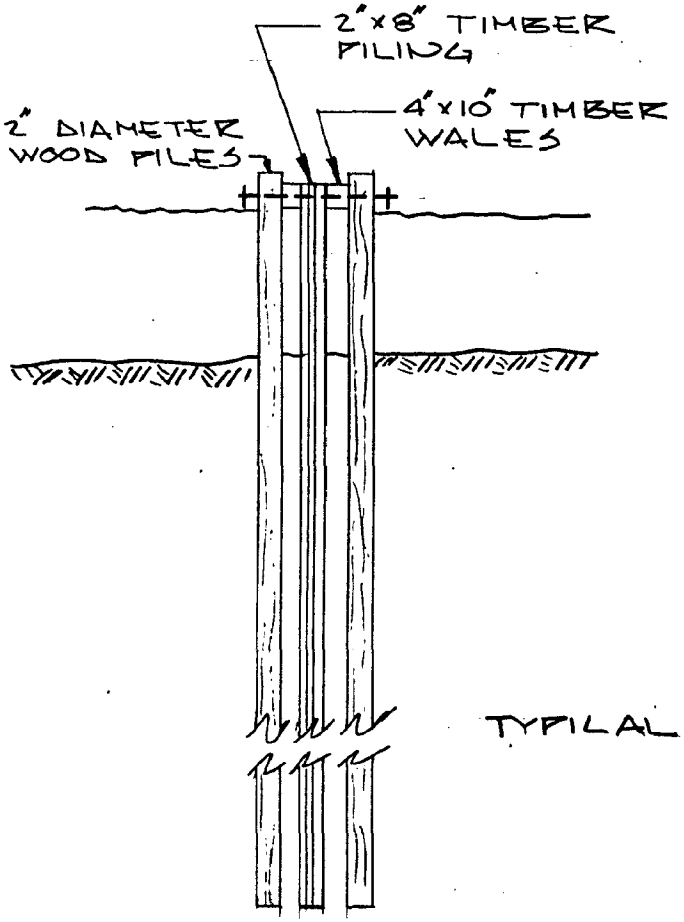
HAGAR TOWNSHIP PARK
EXHIBIT #2

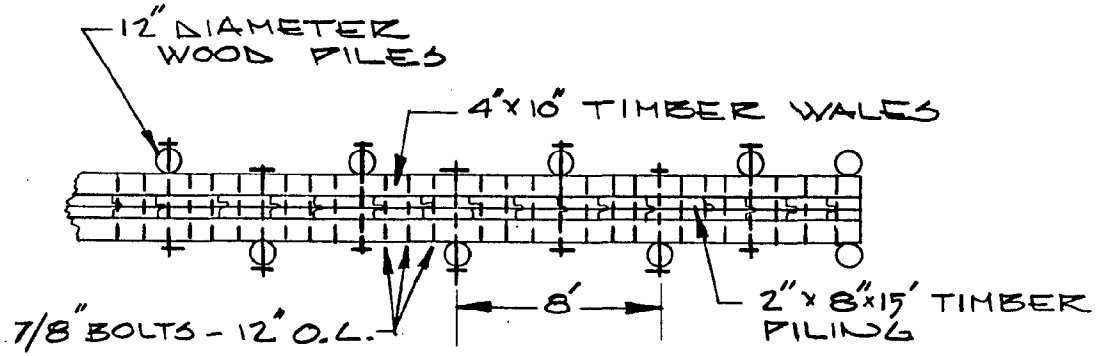


TYPILAL GROIN

ABONMARCHE CONSULTANT, INC.
ENGINEERS-PLANNERS-SURVEYORS

HAGAR TOWNSHIP PARK
EXHIBIT #3

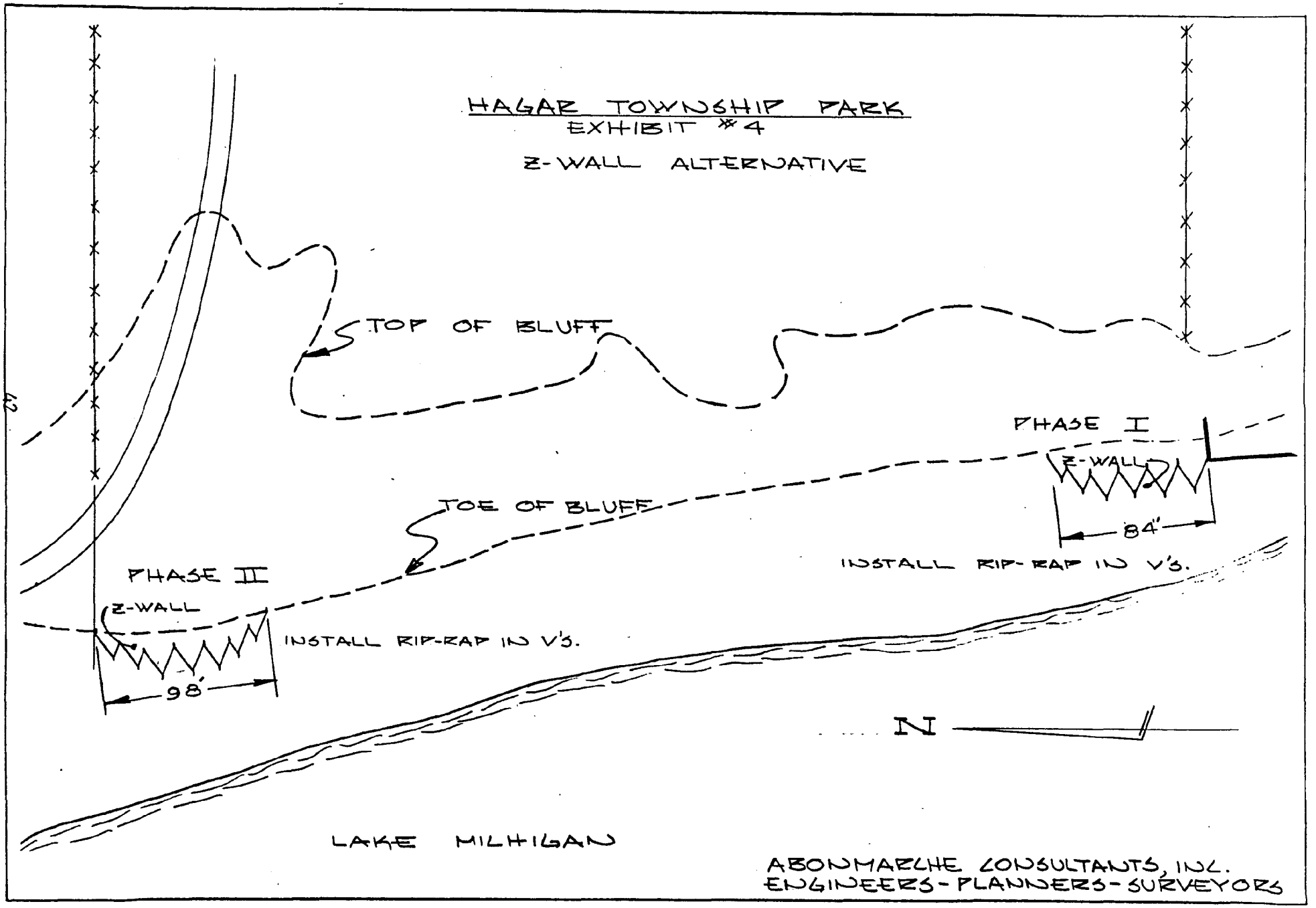




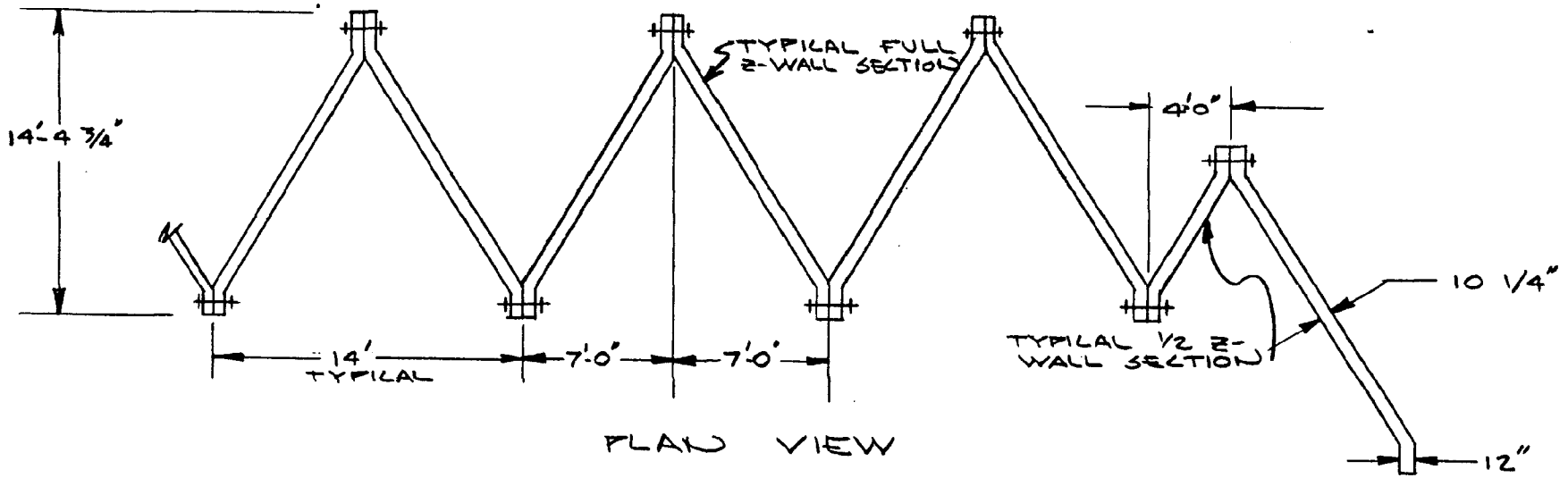
NOTE:
1. ALL TIMBERS AND PILES TO BE PREASURE TREATED WITH WOOD PRESERVATIVE.

TYPILAL GROIN DETAILS

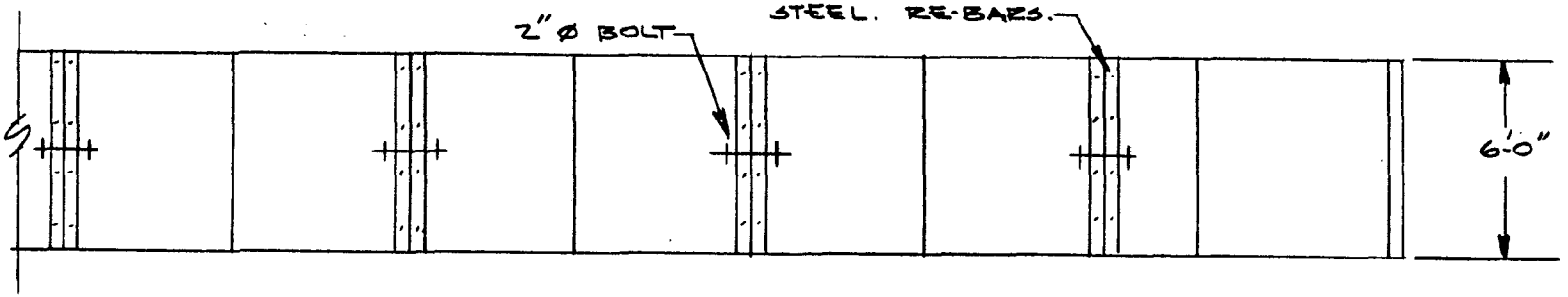
ABONMARLHE CONSULTANT, INC.
ENGINEER- PLANNERS-SURVEYORS


HAGAR TOWNSHIP PARK
EXHIBIT #4
Z-WALL ALTERNATIVE
TOP OF BLUFF
TOE OF BLUFF
PHASE I
Z-WALL
84'
INSTALL RIP-RAP IN V'S.
PHASE II
Z-WALL
INSTALL RIP-RAP IN V'S.
98'
N
LAKE MILHIGAN
ABONMARCHE CONSULTANTS, INC.
ENGINEERS - PLANNERS - SURVEYORS

HAGAR TOWNSHIP PARK
EXHIBIT #5
Z-WALL DETAIL



PLAN VIEW



ELEVATION VIEW

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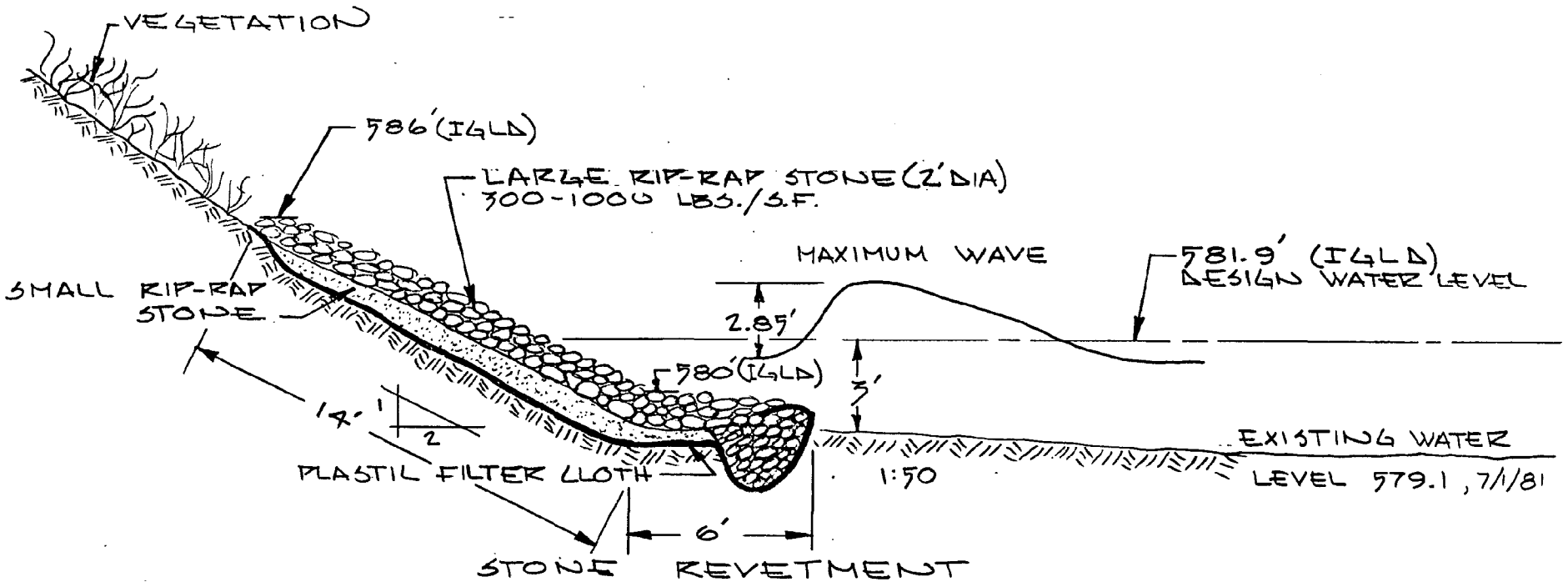
ENGINEERS - PLANNER - SURVEYORS

HAGAR TOWNSHIP PARK
EXHIBIT # 6



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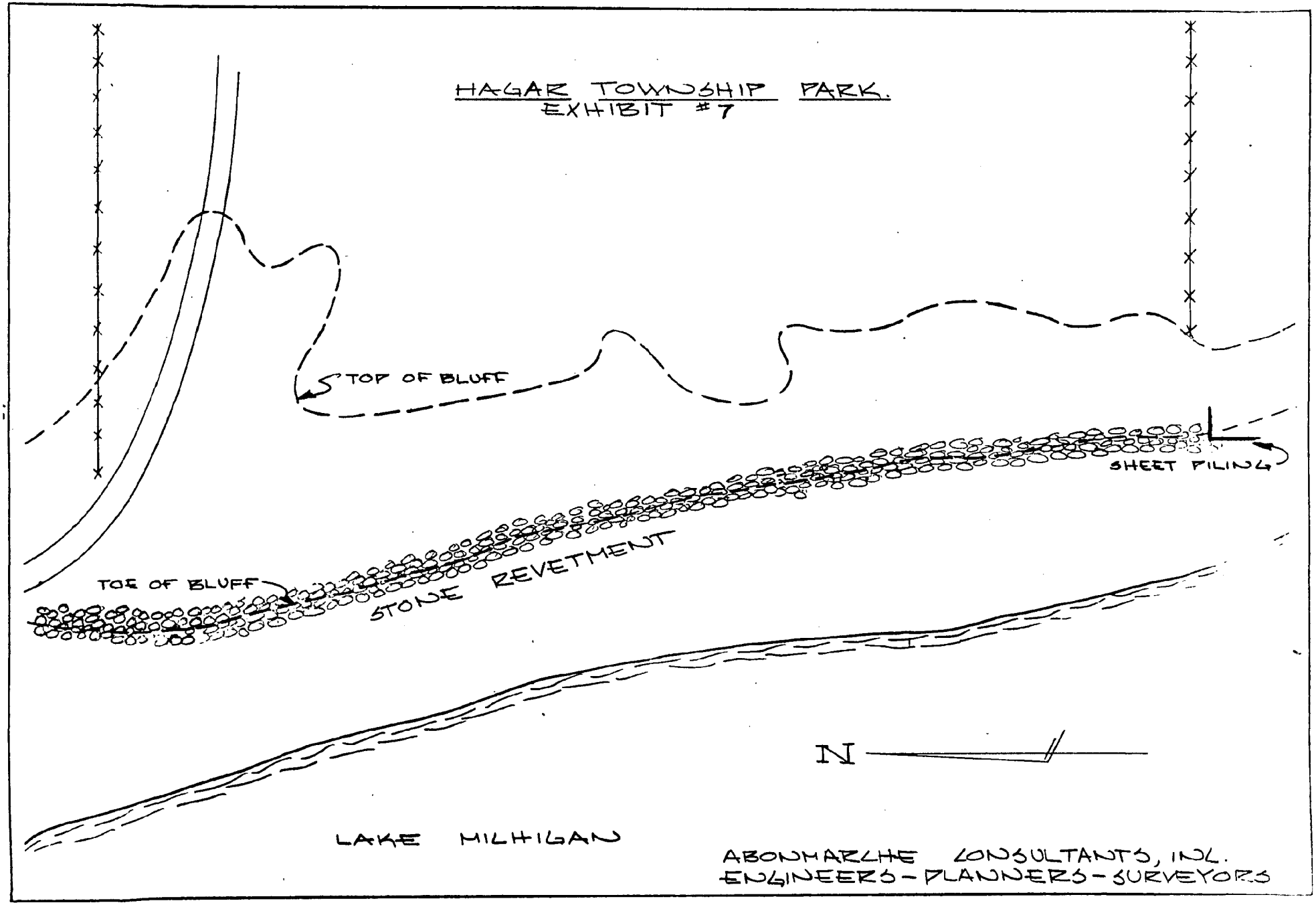
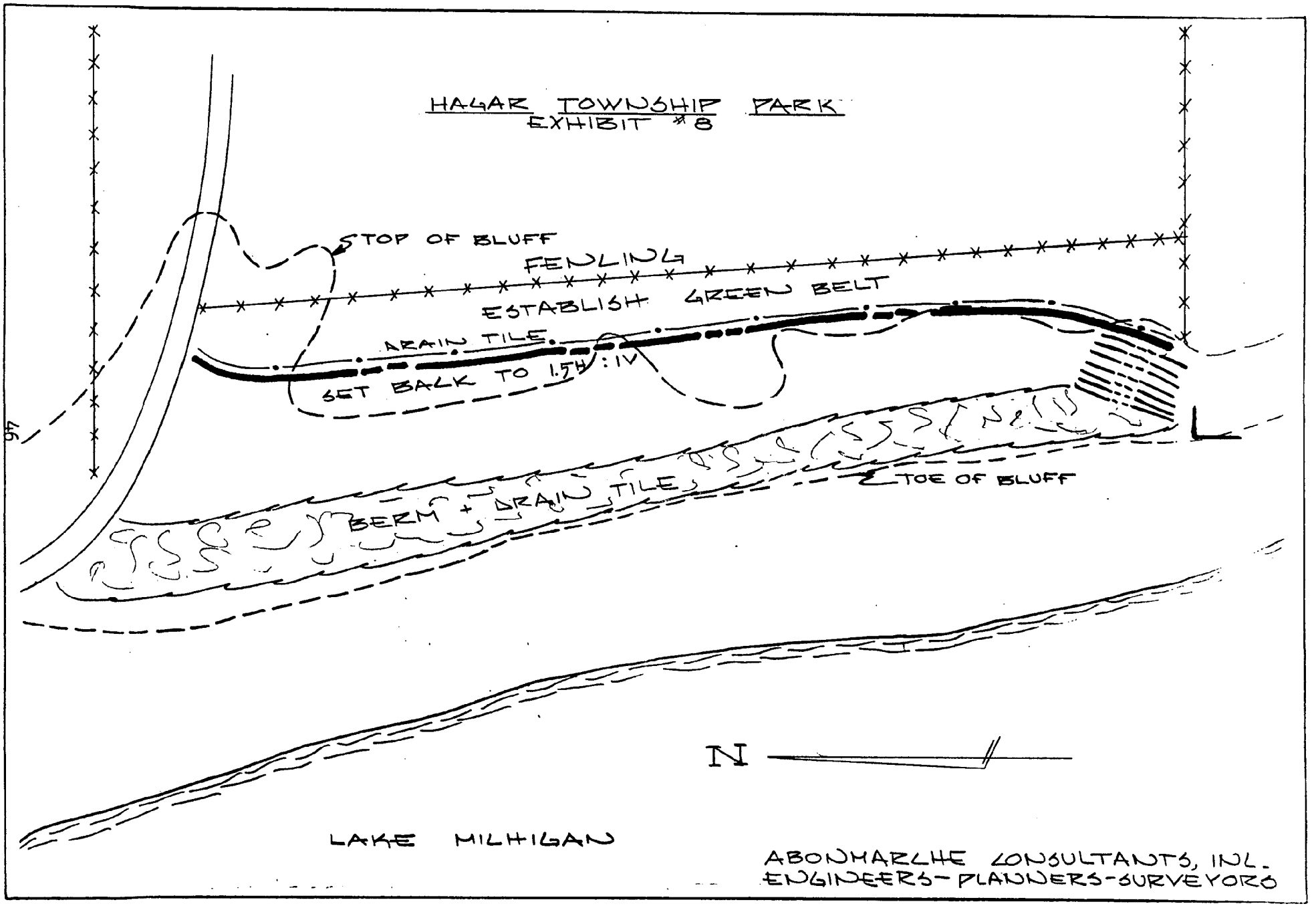
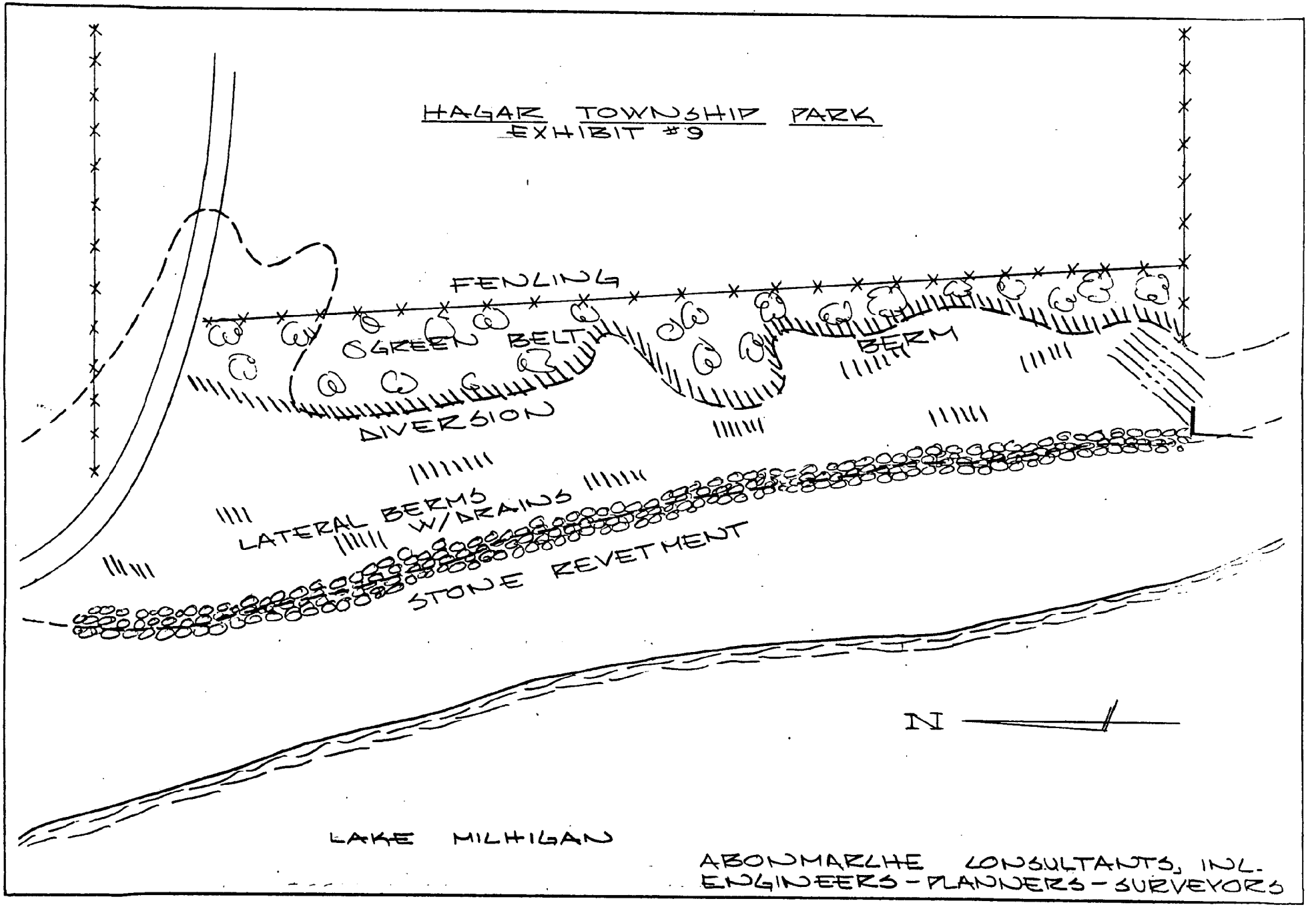
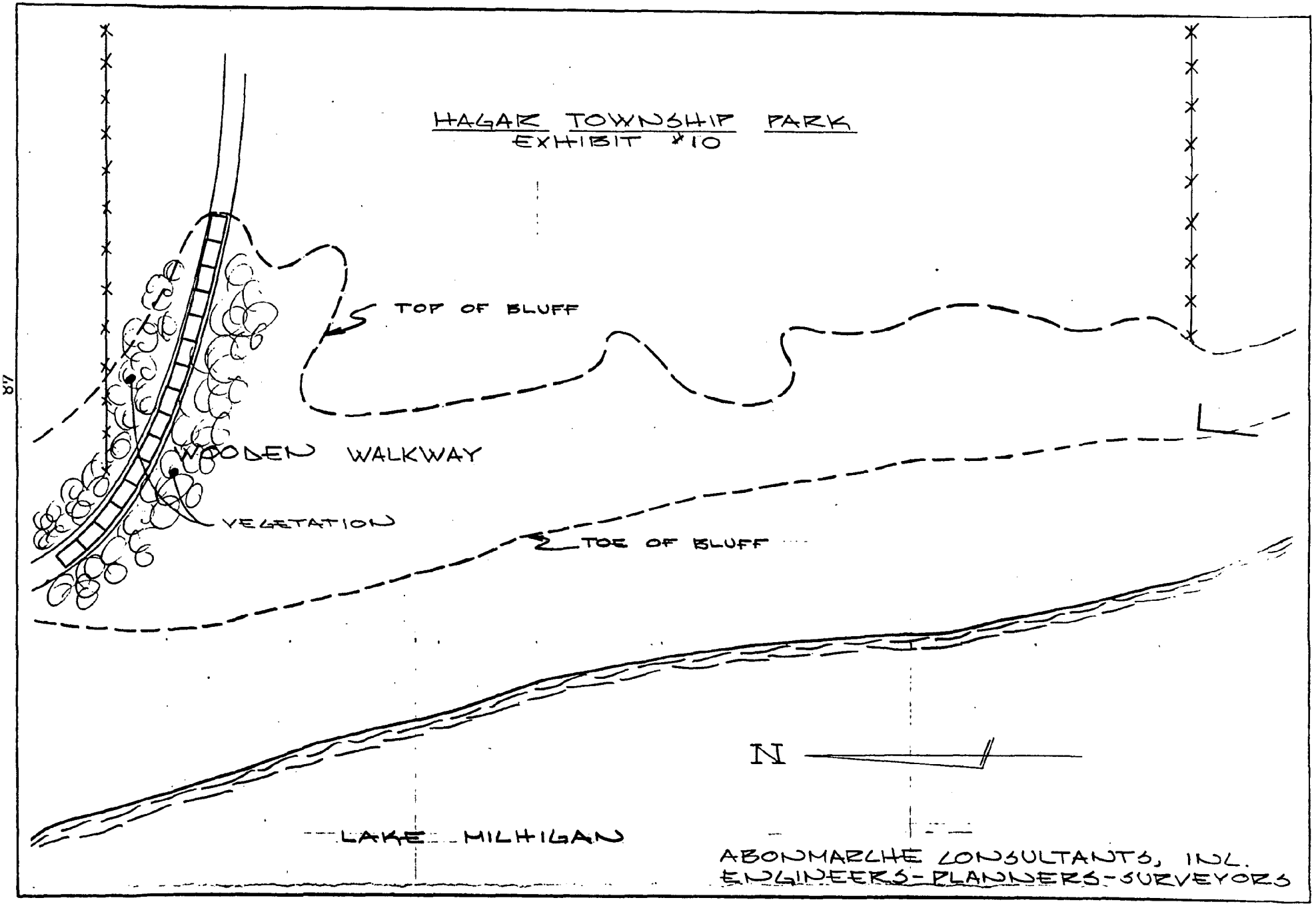
ENGINEERS-PLANNERS-SURVEYORS

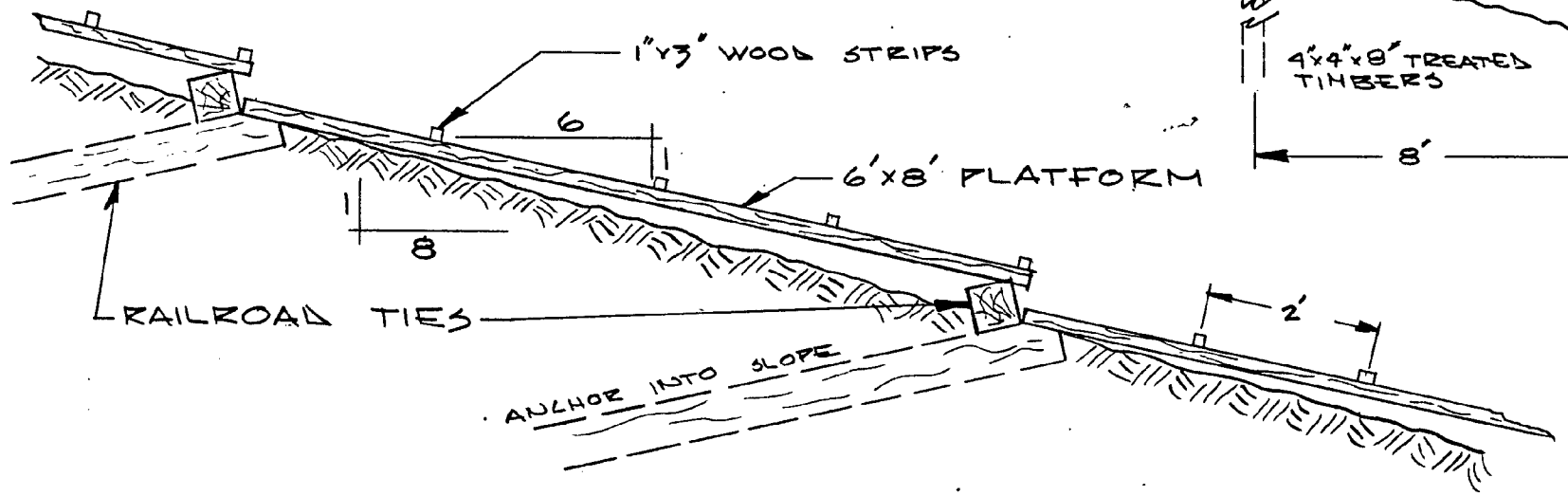

HAGAR TOWNSHIP PARK.
EXHIBIT #7
TOP OF BLUFF
SHEET PILING
TOE OF BLUFF
STONE REVETMENT
N
LAKE MICHIGAN
ABONMARCHE CONSULTANTS, INC.
ENGINEERS - PLANNERS - SURVEYORS


HAGAR TOWNSHIP PARK
EXHIBIT #8
STOP OF BLUFF
FENCING
ESTABLISH GREEN BELT
DRAIN TILE
SET BACK TO 1.5H : 1V
TOE OF BLUFF
BERM + DRAIN TILE
N
LAKE MICHIGAN
ABONMARCHE CONSULTANTS, INC.
ENGINEERS-PLANNERS-SURVEYORS


HAGAR TOWNSHIP PARK
EXHIBIT #9
FENCING
GREEN BELT
BERM
DIVERSION
LATERAL BERMS W/DRAINS
STONE REVETMENT
N
LAKE MICHIGAN
ABONMARCHE CONSULTANTS, INC.
ENGINEERS - PLANNERS - SURVEYORS

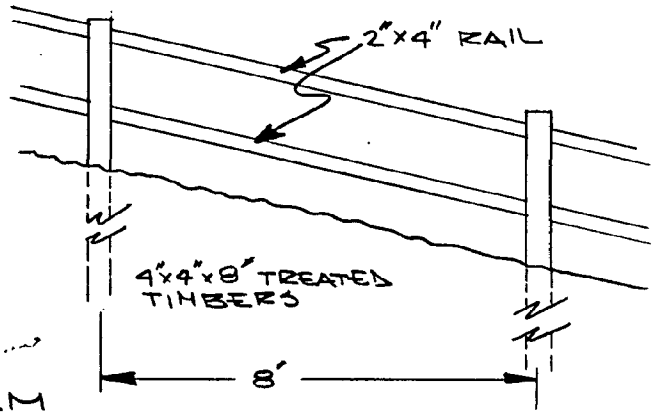

HAGAR TOWNSHIP PARK
EXHIBIT #10
TOP OF BLUFF
WOODEN WALKWAY
VEGETATION
TOE OF BLUFF
N
LAKE MILHIGAN
ABONMARCHE CONSULTANTS, INC.
ENGINEERS-PLANNERS-SURVEYORS

HAGAR TOWNSHIP PARK
EXHIBIT #11



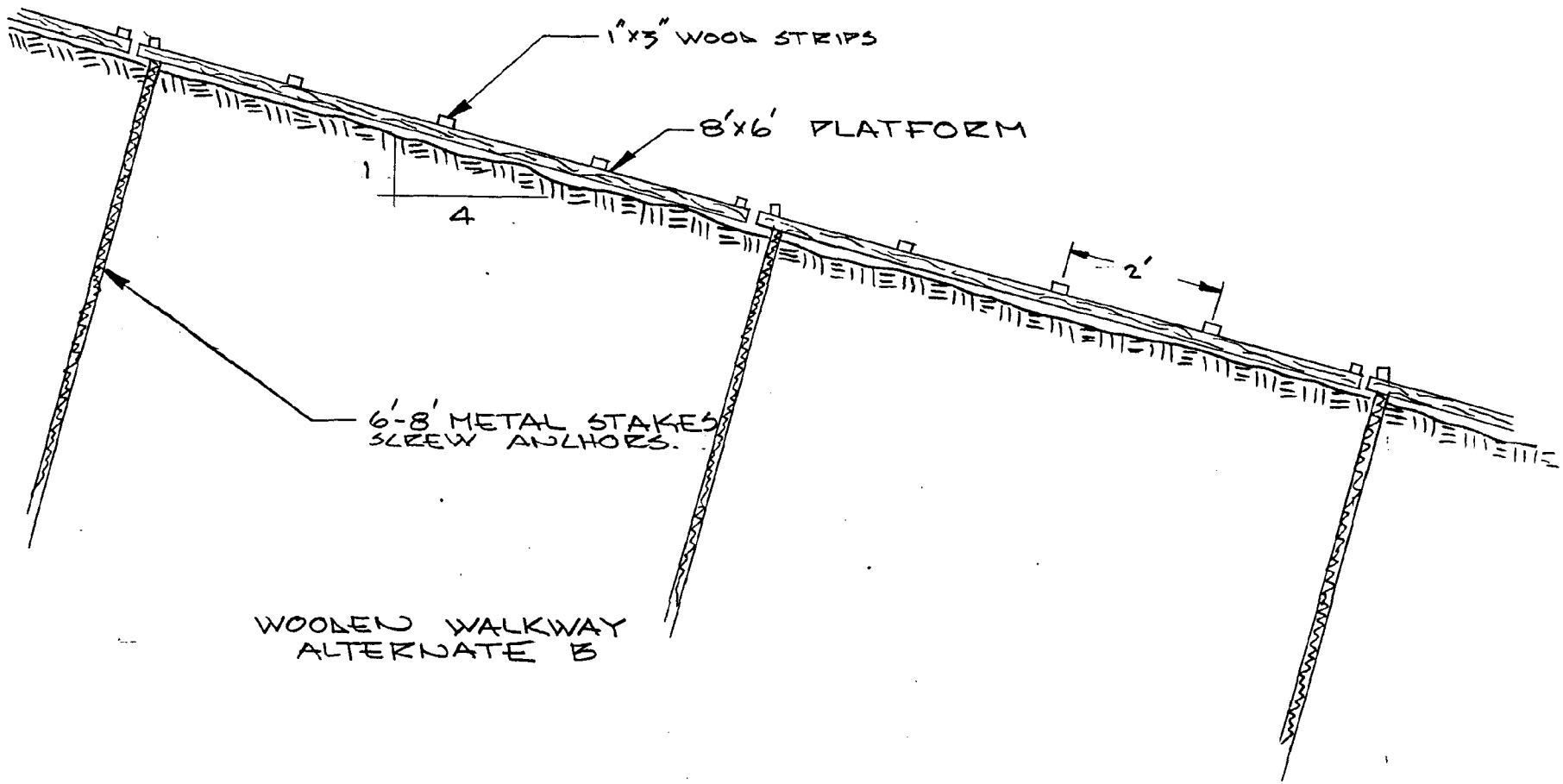
WOODEN WALKWAY
ALTERNATIVE A

TYPICAL HANDRAIL



ABONMARCHE CONSULTANTS, INC.
ENGINEERS-PLANNERS-SURVEYORS

HAGAR TOWNSHIP PARK
EXHIBIT #12



WOODEN WALKWAY
ALTERNATE B

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SECTION III

HAGAR TOWNSHIP PARK

IMPLEMENTATION

ABONMARCHE CONSULTANTS, INC.
Benton Harbor, Michigan

August, 1981

9. IMPLEMENTATION

Development of park improvements and erosion control measures will be contingent upon the financial resources available. Township funds are limited. County funding is not available at this time and is not likely to become available.

Successful development of Hagar Township Park will be tied to the Townships ability to leverage additional funding from Federal grant programs. Two funding programs remain available; The Coastal Zone Management Program (CZM) and the Resource Conservation and Development Program (RC&D).

9.1 Coastal Zone Management:

An application for $50,000 in construction funds has been submitted to CZM for Hagar Township. CZM funding for construction projects is ending. If this application is approved, it will be the last opportunity to use this program for construction.

The CZM program requires a 20% local participation. The $50,000 request would be matched by $12,500 from Hagar Township resulting in a potential construction budget of up to $62,500 for 1982.

CZM will fund site improvements such as: recreational improvements, fencing, parking lot, walkway, bluff cutback, and bluff and walkway revegetation. However, CZM will not fund erosion control structures such as: groins, stone revetments or Z-walls.

9.2 Resource Conservation and Development:

The Sauk Trails RC&D District Office has placed Hagar Township Park on a list of potential funding projects for "Critical Area Treatment Measures (Erosion and Sediment Control)". This program applies to critically eroding areas which cannot

be stabilized by ordinary conservation and management measures, and if left untouched would cause severe sediment or erosion damage. These measures may be carried out on critically eroding areas on public or private lands that:

(1) if left untouched will adversely affect the community or the general public, and
(2) the treated area will be maintained in trees, shrubs, and grass or other protective cover.

Eligible practices include, but are not limited to:

(1) Critical area planting
(2) Fencing (except boundary fences)
(3) Grade stabilization structures
(4) Stone Revetments - Riprap
(5) Mulching
(6) Tree planting
(7) Terraces
(8) Subsurface drains needed to stabilize critical areas.

The RC&D Critical Area Program requires 25% local participation for Critical Area Treatment Measures.

Another funding resource through RC&D is for Basic Facilities. Under this program waterbased recreation is an eligible activity. Eligible improvements include:

(1) roads, trails, paths and walks providing access from public highways and between different parts of the development
(2) parking areas
(3) scenic overlooks, observation towers and platforms
(4) water, electric and sanitary facilities for the park

The RC&D Basic Facilities Program requires a 50% local participation.

There is a waiting list locally for funding through the Sauk Trails RC&D office. Funding is on a first come-first served basis among eligible projects. The local office indicates late 1982 or 1983 would be a realistic estimate for a funding timetable.

Of critical impact to this project is the fact that RC&D will only fund shoreline erosion structures above the ordinary high water mark. It is their position that devices constructed below that point are the responsibility of the U.S. Army Corp of Engineers.

As funding is not available from the Army Corps, this issue effectively eliminates the recommended option of revetment at the toe of the bluff combined with beach stabilization groins. This option is not cost effective without substantial Federal cost participation, and such participation is not currently available.

The recommended alternative of installation of Z-wall panels at the toe of the bluff above the ordinary high water mark to inhibit wave erosion or at the southerly property line to stabilize the beach is eligible for funding as a Critical Area Treatment through Sauk Trails RC&D Council.

The following implementation alternatives are designed to maximize federal grant participation due to the limited financial resources of Hagar Township. Several alternatives are presented to give the Township a variety of options while ensuring a complimentary mix of improvements are considered.

The implementation alternatives are presented in order of decreasing cost while reflecting on effective mix of recommended implementation measures.

9.3 ALTERNATE I

This alternate is a two year project designed to fully implement recommended park improvements and beach and bluff stabilization measures within the parameters of existing federal grant programs. 1982 CZM construction funding will be utilized to implement recreational improvements, etc., on top of the bluff. 1983 RC&D funding will be utilized for beach and bluff stabilization measures.

1982 PARK DEVELOPMENT (CZM)

1.	Parking lot improvements	$18,000
2.	Park improvements less tennis courts	17,100
3.	Park entrance drive	3,400
4.	Alt. A. beach access walkway	10,300
5.	Engineering, administration & contingency @ 15%	7,300
		$56,100

CZM $44,900 local $11,200

1983 BEACH AND BLUFF STABILIZATION (RC&D)

1.	Remove stairway	$ 6,000
2.	Excavate slope 1.5:1.0	7,500
3.	Install bluff fencing	2,200
4.	Plant grass & trees	2,000
5.	Install Z-wall	72,200
6.	Engineering, administration & contingency @ 15%	13,500
		$103,400
	1983 construction + 12%	12,400
		$115,800

RC&D $86,900 local $28,900

9.4 ALTERNATE II

This alternate is also a two year project which scales back the amount of improvements while maintaining a viable project concept. Due to the past performance of Z-wall on similar beach environments, it is possible that installation of Z-wall at the south property line will mitigate the most serious bluff erosion problem while building up additional beach to protect the remainder of the bluff. If needed, the remaining Z-wall could be installed sometime in the future.

1982 PARK DEVELOPMENT ITEMS (CZM)

1.	Parking lot improvements	$18,000
2.	Park improvements excluding US33 fence & tennis courts	11,500
3.	Entrance drive	3,400
4.	Walkway	10,600
5.	Engineering, administration & contingency @ 15%	6,500
		$50,000

CZM $40,000 local $10,000

1983 BEACH AND BLUFF STABILIZATION (RC&D)

1.	Z-wall south section	$14,300
2.	Stairway removal	6,000
3.	Excavate bluff	7,500
4.	Beach grass & trees	2,500
5.	Bluff fence	2,200
6.	Engineering, administration & contingency @ 15%	4,900
		$37,400
	1983 Const. + 12%	4,500
		$41,900

RC&D $31,400 local $10,500

9.5 ALTERNATE III

This alternate considers the minimum level of improvements to restrict access, provide recreational improvements, and mitigate beach and bluff erosion. Additional erosion control measures can be installed at a later date as needed and as funding is available. If RC&D monies are available in 1982, this alternate could be constructed in one year.

PARK DEVELOPMENT ITEMS (CZM)

1.	Parking lot improvements	$18,000
2.	Park improvements excluding fence along US33 & tennis courts	11,500
3.	Entrance drive	3,400
4.	Bluff fencing	2,200
5.	Beach grass & trees	2,500
6.	Walkway	10,300
7.	Stairway removal	6,000
8.	Engineering, administration & contingency @ 15%	9,200
		$63,100

CZM $50,000 local $13,100

BEACH AND BLUFF STABILIZATION (RC&D)

1.	Z-wall south section	$14,300
2.	Engineering, administration & contingency @ 15%	2,100
		$16,400

RC&D $12,200 local $ 4,200

10. REVENUE PRODUCING POTENTIAL

Periodically, throughout the summer of 1981, the park site was visited to gain a perspective of user characteristics on high use days. This was not an attempt to perform a statistical analysis. But was rather a subjective evaluation gained through observation and interviews.

10.1 USER CHARACTERISTICS

At a given time, on a weekend afternoon with good weather, between 40 and 60 vehicles would be parked in the park. The vehicles were usually evenly divided between Michigan and out-of-state license plates. Michigan vehicles were generally local. Out-of-state plates were generally owned by persons who owned or rented cottages or second homes locally. Comparatively few park users arrived from outside of Berrien County for the purpose of using Hagar Township Park.

An average of 3 persons per vehicle arrived, and throughout the day there was a fairly slow but regular turnover. A typical stay in the park was about 4 hours and roughly a total of 80 different vehicles would arrive. Total daily usage on a weekend averaged 200 to 240 persons.

10.2 REVENUE POTENTIAL

As the park is improved, we would expect local usage to increase, predominantly by drawing persons who are currently using "Roadside" beach in the northern portion of the township. However, we do not anticipate enough additional usage to justify typical revenue producing efforts, such as, sale of user permits or concession for refreshments.

The administrative problems involved in a permit system would outweigh revenue received from the comparatively small number of park users.

As most park users are staying in a local home or cottage, the revenue potential from the sale of refreshments is fairly limited, in comparison to other facilities where the day user originates outside the local area.

11. OPERATION AND MAINTENANCE COSTS

The recommended development strategy is designed to minimize annual maintenance.

- Fencing: Quality chain link fencing, properly installed, will be largely maintenance-free and have a life expectancy in excess of 20 years. There is a potential for vandalism which should promptly be repaired.
- Parking Lot: The proposed gravel lot may occasionally need additional gravel or some grading to fill holes.
- Walkway: The walkway is designed to be replaceable in 8 ft. sections for ease of maintenance. Lower sections could be removed during the winter to minimize potential damage.
- Erosion Control - The cost effective erosion control measure of Z-wall and plantings is largely maintenance-free and would not be an annual cost.
- Equipment: Tables, grills and recreation equipment should be removed and stored during the off season.

Most maintenance costs the township will face, will be people related, such as, litter and vandalism. Litter and vandalism can be minimize through proper security, supervision, lighting and regularily emptied trash receptacles.

A two man crew, working two weeks a year, will be able to perform typical annual maintenance efforts. A week will be necessary to open the park in the spring and a week will be necessary to close the park in the fall. During the balance of the summer, part-time student help may be necessary for cleaning and litter removal.

An annual budget of $5,000 for manpower and material should be sufficient for normal maintenance expenses.

HEAVY MAINTENANCE

2 man crew/2 weeks	=	160 hours	@ $8.00/hour	= $1,280

OPERATIONAL MAINTENANCE

Part-time student		20 hrs/wk x 13 wks = 260 hours	@ $4.00/hour	= $1,040
Supplies, equipment and material				$2,680
				$5,000

The full amount allocated for supplies, equipment and material will not be used each year and the balance should be reserved and allowed to accumulate for unexpected or extraordinary maintenance costs.

12. IMPLEMENTATION SCHEDULE

12.1 Alternate Selection

At a special meeting on September 1, 1981, the Hagar Township Board of Trustees selected Alternate III for implementation in 1982. Further, at that meeting the township announced approval of construction funding through the Great Lakes Shorelands Section, Michigan Department of Natural Resources. Approval by the Federal office of Coastal Zone Management is anticipated by October 1, 1981 for the 1981-82 fiscal year.

Upon completion, this study will be forwarded to the staff of the Saulk Trails RC&D office where a measure plan will be completed. RC&D construction funding is possible during fiscal year 1981-82. As CZM construction funds cannot be carried over, RC&D funding for 1981-82 in a coordinated manner will be helpful to ensure the erosion control device is installed before bluff plantings are put in place.

12.2 Implementation Schedule

Assuming funding is approved, the following implementation schedule is anticipated. This schedule may be modified if RC&D funds are not forthcoming.

October, 1981: CZM final approval and contract executed between Township and Consultant for final design, specifications, bid and contract documents, and construction management services.

October, 1981 - December, 1981: Final design and construction drawings completed. Permit process initiated. RC&D measure plan completed and approved.

January, 1982 - February, 1982: Bid, specifications, and contract documents completed.

March, 1982: Bids advertised and let. Contractor(s) selected (pending permit approval)

April - June, 1982: Construction completed.

July 4, 1982: Project completed and opened to public.

BERRIEN COUNTY COURTHOUSE

BERRIEN COUNTY
PLANNING DEPARTMENT
AARON ANTHONY, DIRECTOR

OFFICE OF:
Planning Department
ST. JOSEPH, MICHIGAN 49085
TELEPHONE: 616 / 983-7111, EXT. 254

August 25, 1981

Abonmarche Consultants, Inc.
Brian W. Sodt
95 West Main Street
Benton Harbor, MI 49022

Dear Mr. Sodt:

This letter is in reply to your inquiry as to the availability of recreation funds from the County.

Since the acquisition of the Bi-State/Manion property, all County development funds directed towards recreation are earmarked for the Bi-State Park in order to bring that park into usable shape. I am not aware of any funds not already allocated.

If you have any additional questions, please contact me.

Sincerely,

BERRIEN COUNTY PLANNING DEPARTMENT

Aaron Anthony, Planning Director
rlc